A topographic map of the Kishwaukee River Basin, showing the river's course through a hilly landscape. The map includes labels for various counties such as Winnebago, Boone, Wisconsin, Illinois, McHenry, and Ogle. Towns like South Beloit, Harvard, Woodstock, Mahan, Crystal Lake, Hampshire, De Kalb, St. Charles, and Geneva are marked. The Kishwaukee River is the central feature, with its tributaries like the Fox River and Rock River also visible.

# Kishwaukee River Basin Land use Evolution

An Application of LEAM to the  
Kishwaukee Watershed

# Charrette Tasks

1. To inform and to be informed
2. To take preliminary steps toward developing a vision for the area
  - What are the forces that cause land-use change in the region?
  - What are the policies and investments that you would like to see implemented in the region?



# Overview

- Background
- Understanding LEAM
- Meeting objective
  - Drivers and Scenarios
- Generic LEAM
- Specific tasks

# Background

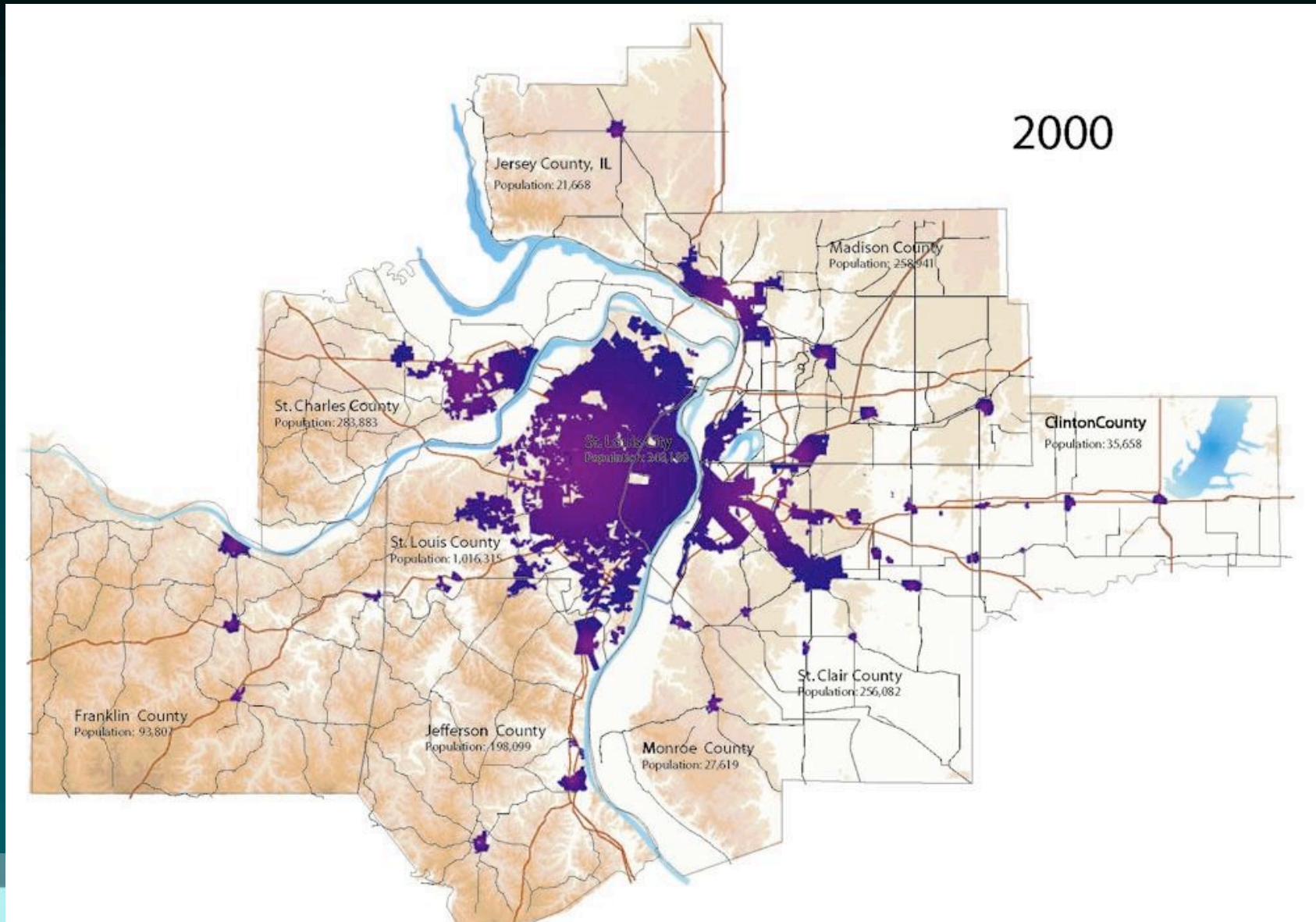


# Planning for a Region

Finding answers to three questions

- Where are we now?
- Where do we want to be?
- How do we get there?

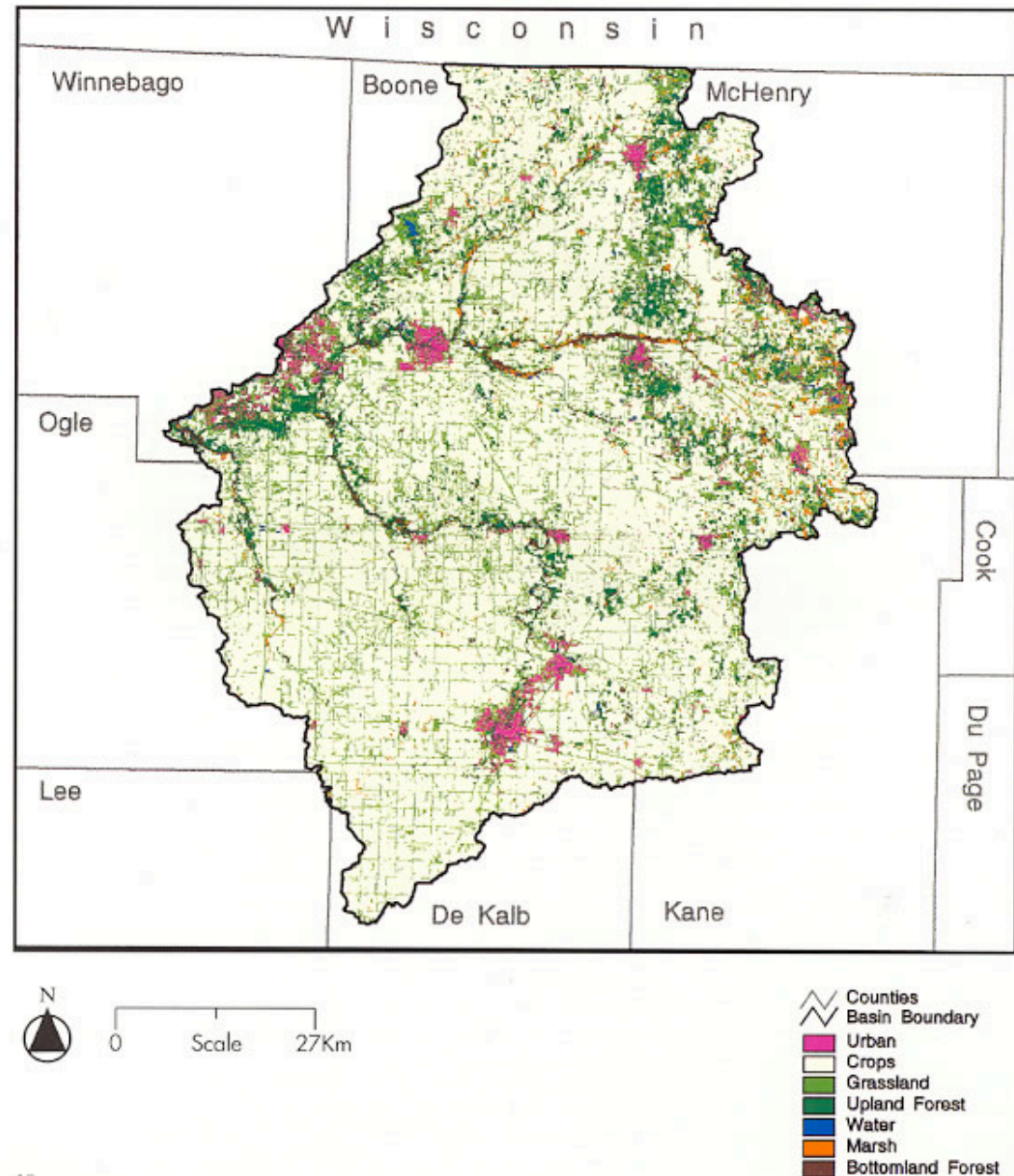
# Where have we been?





# Where are we now?

## LAND COVER IN THE KISHWAUKEE RIVER BASIN



# Where Do We Want to Be?

- This question is harder to answer
  - Requires a vision for the region
  - Requires communal consensus
  - But wishful thinking is not very useful
- Must know future land-use patterns resulting from
  - Economic, social, and environmental forces
  - Public policies and investment decisions
- For example, the proposed new IL-MO bridge
  - Do we know how it will affect land-use patterns?



# The Landuse Evolution and Impact Assessment Model

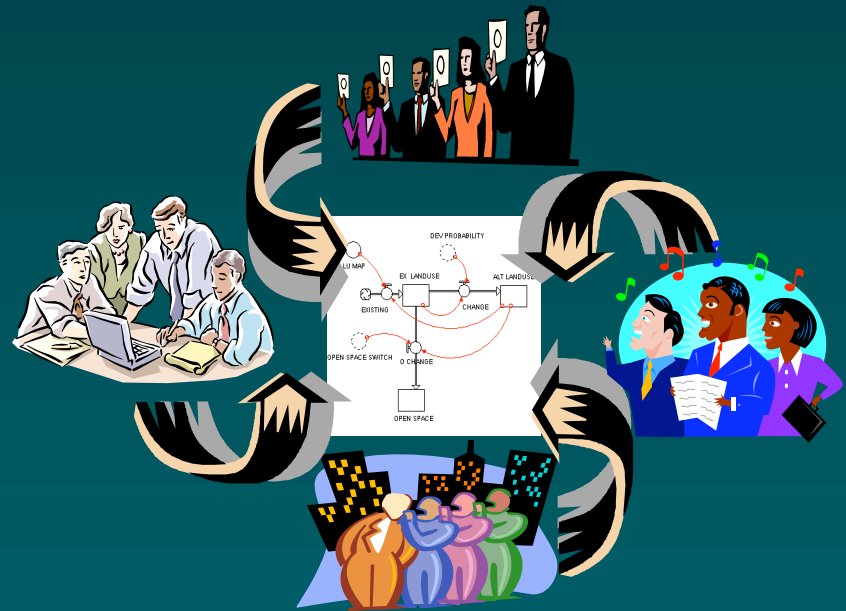
# LEAM

A Scenario Modeling Tool

University of Illinois  
Department of Urban and Regional Planning

# Simulating Land-Use Change

- What factors cause change and how?
  - Translate this into mathematical equations
- Computers simulate changes over space and time
  - Alter equations to play out different scenarios

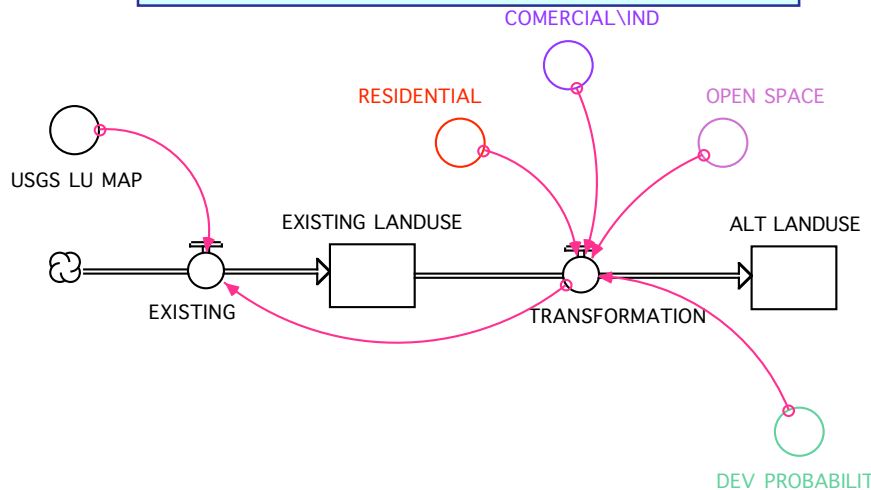




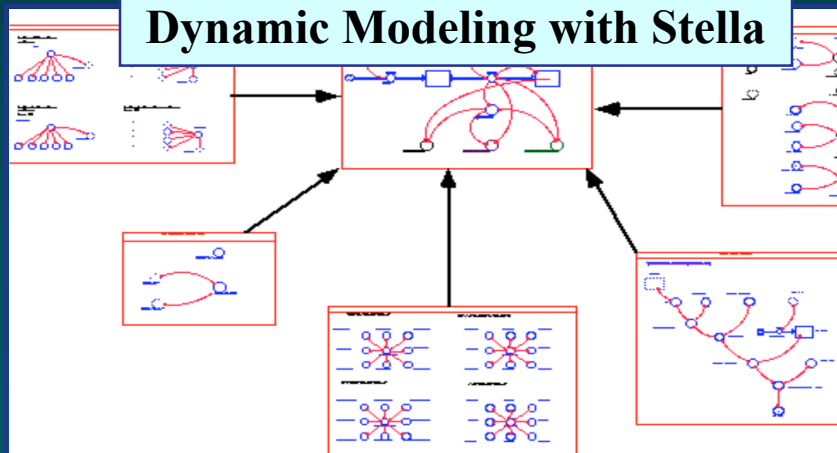
# LEAM

- Models mechanisms of land-use change and impacts
  - Allows playing out and evaluating scenarios
    - Policy choices, public investments, economic and demographics trends
- Hybrid modeling approach
  - regional and cell-based drivers of change
- Cell-based models run in high-performance computing environments
  - Large regions at a very fine resolution
  - Change in 30m x 30m cells across a 5500 sq. mile region

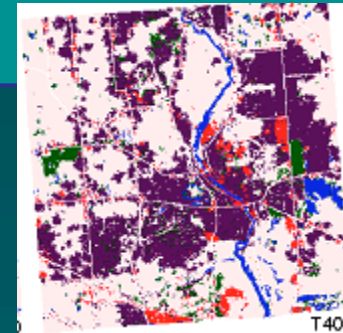
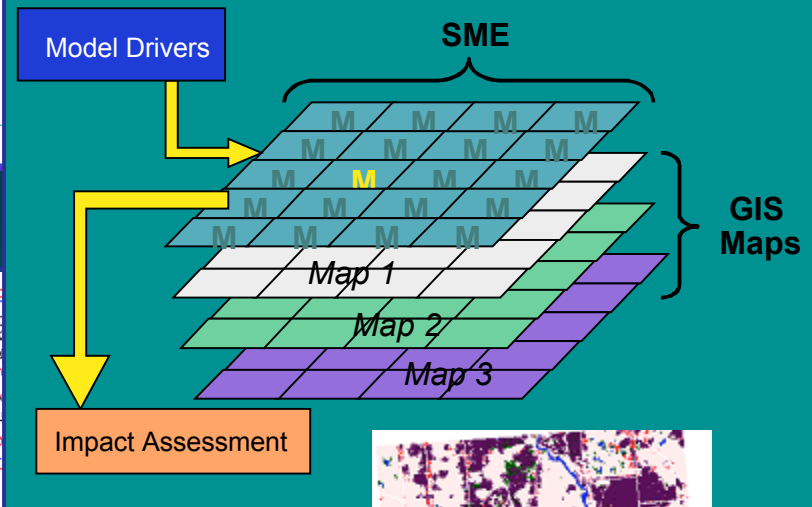
## Land-use Drivers Dynamic Modeling with Stella



## Land-use Impacts Dynamic Modeling with Stella



## Land-use Change Spatial Modeling with SME



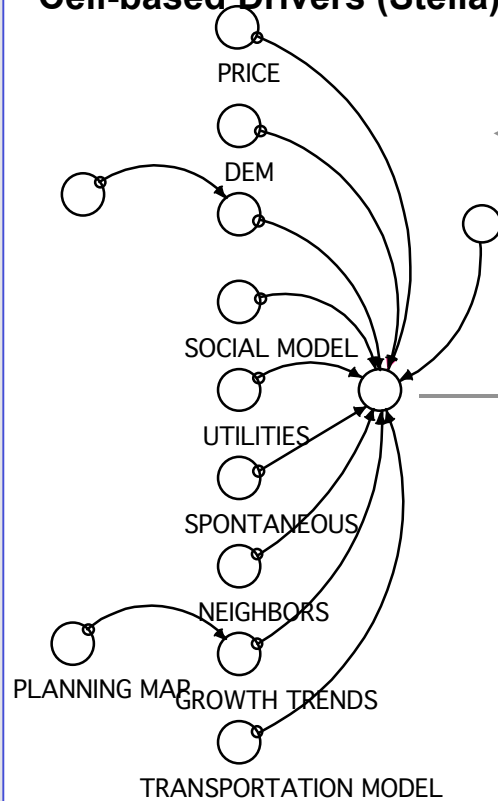
## Regional Driver

Economic Model

Households, Jobs

## SME

### Cell-based Drivers (Stella)



Development Probability

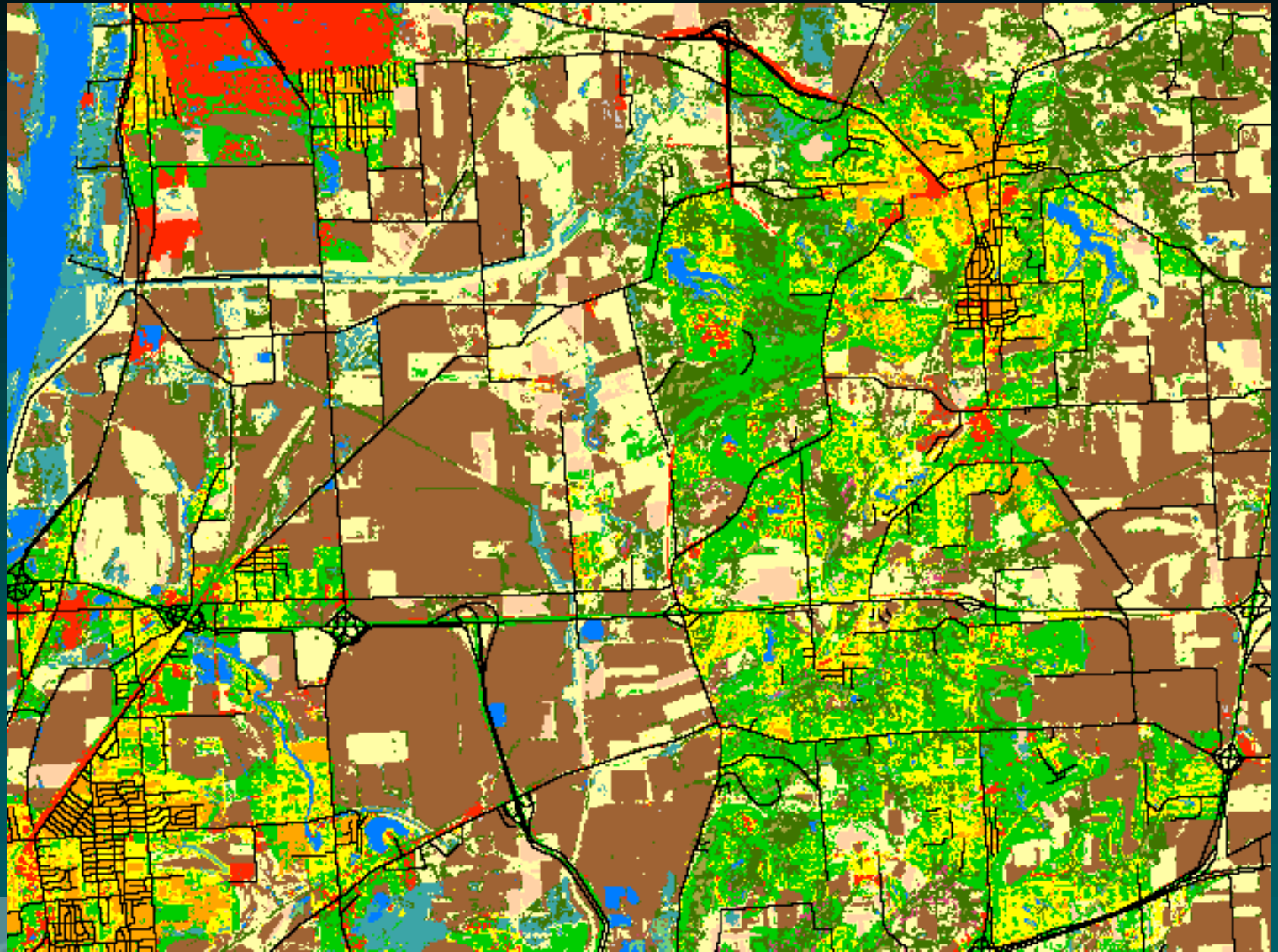
Land use (T)  
GIS Maps  
Impacts

Land use (T+1)

Impacts

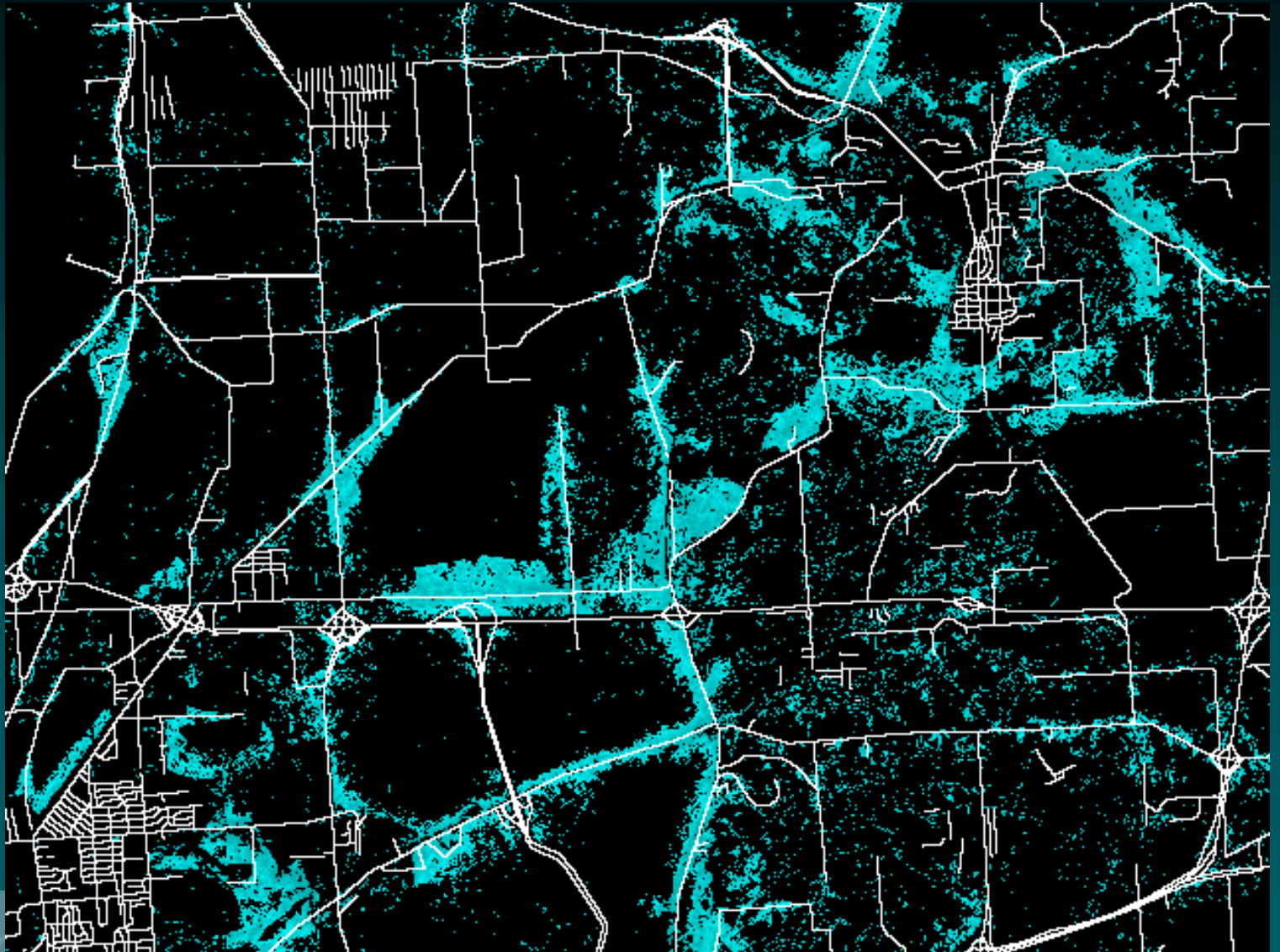
Calibration Weighting

# Simulation Results



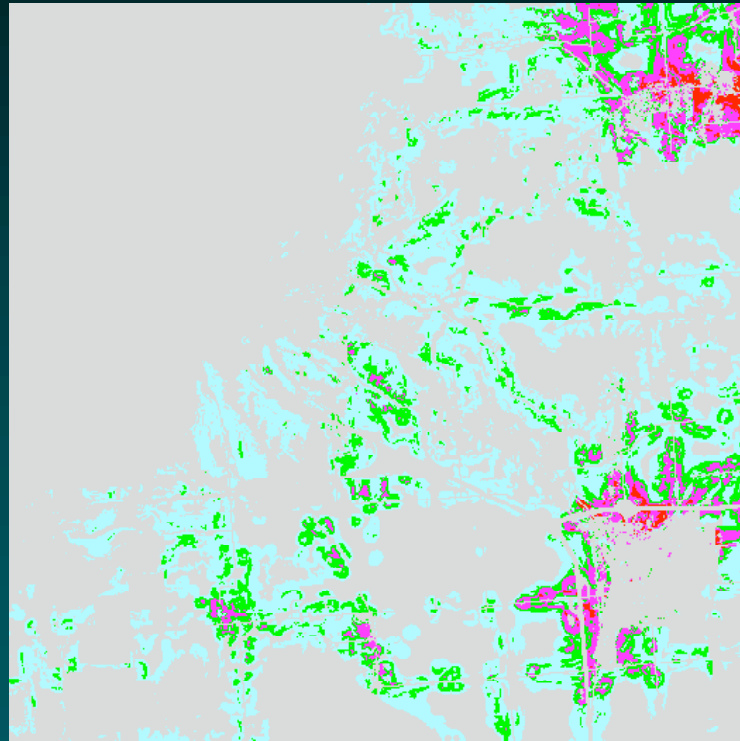


# Simulation Summary

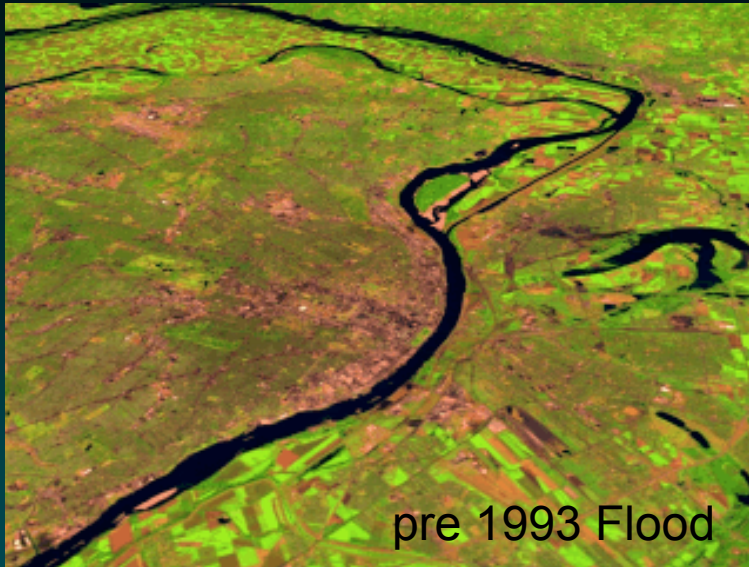


# Scenario Comparisons

# Probability Maps



# Impacts



pre 1993 Flood



1993 Flood

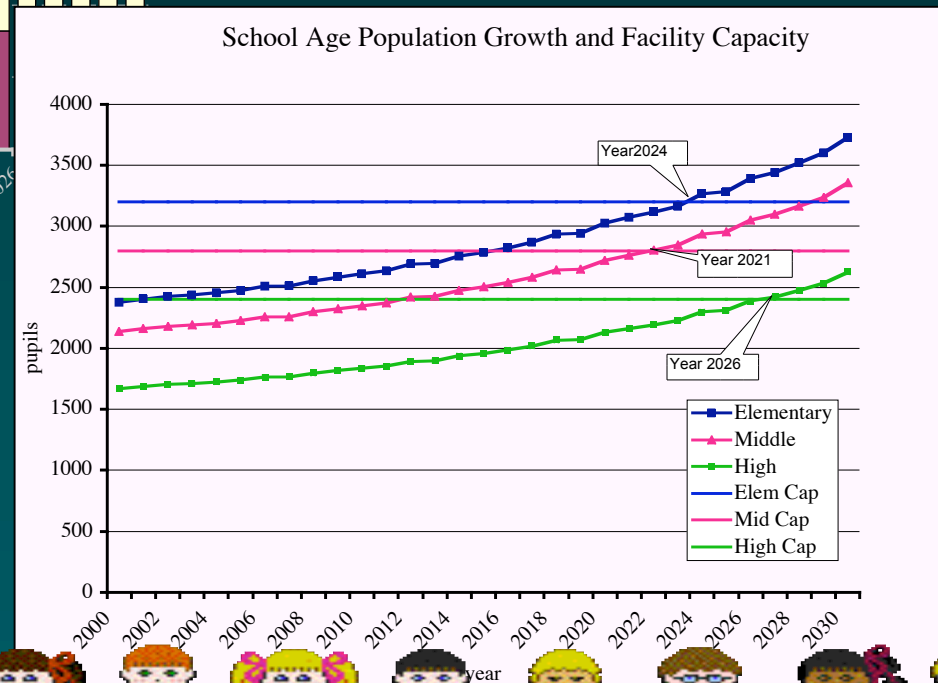
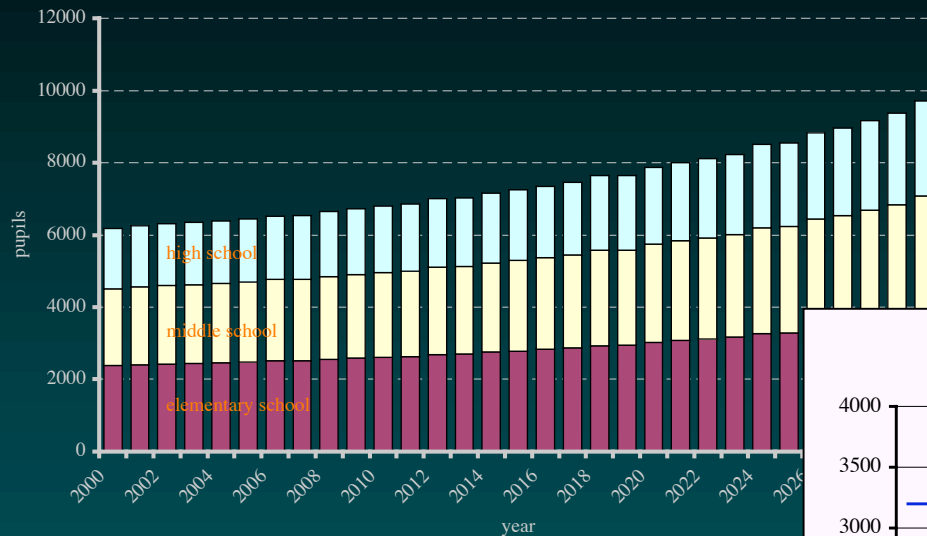
- Storm water/flood damage
- Loss of open space
- Water quality
- Air quality
- Traffic congestion
- Education
- Workforce development
- Fiscal





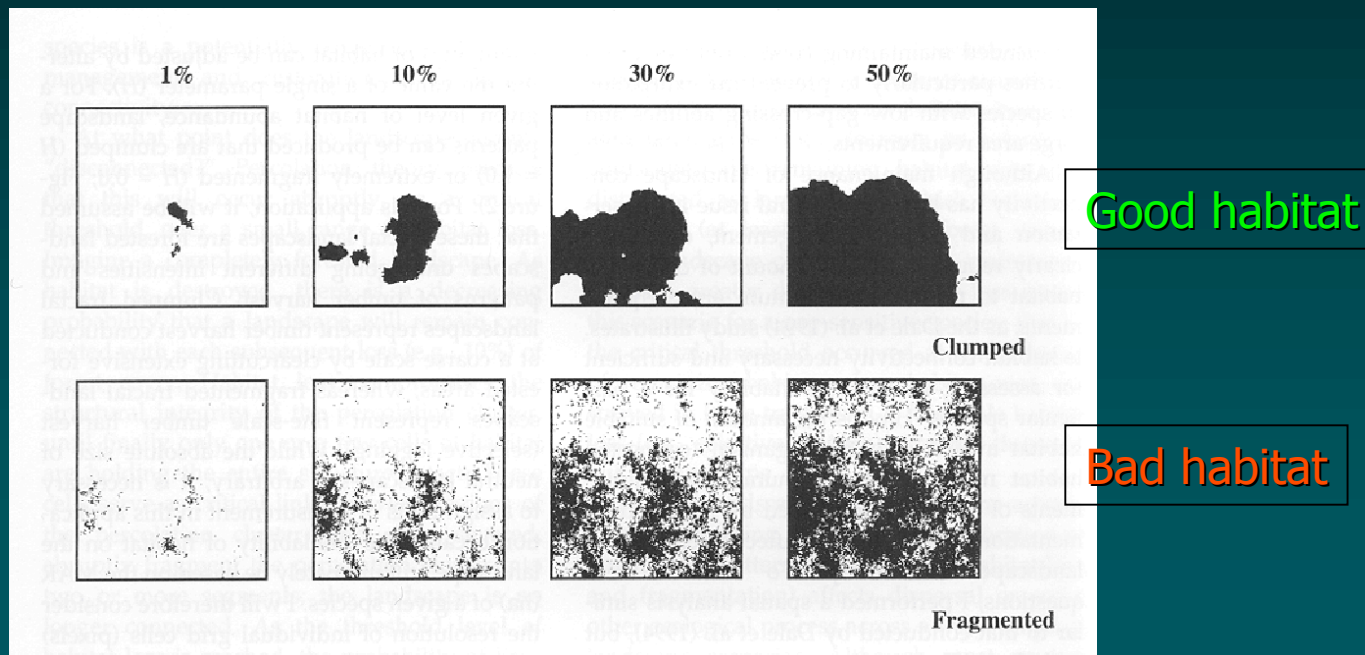
# School Costs Analysis

School Age Population Growth  
East Peoria District 309



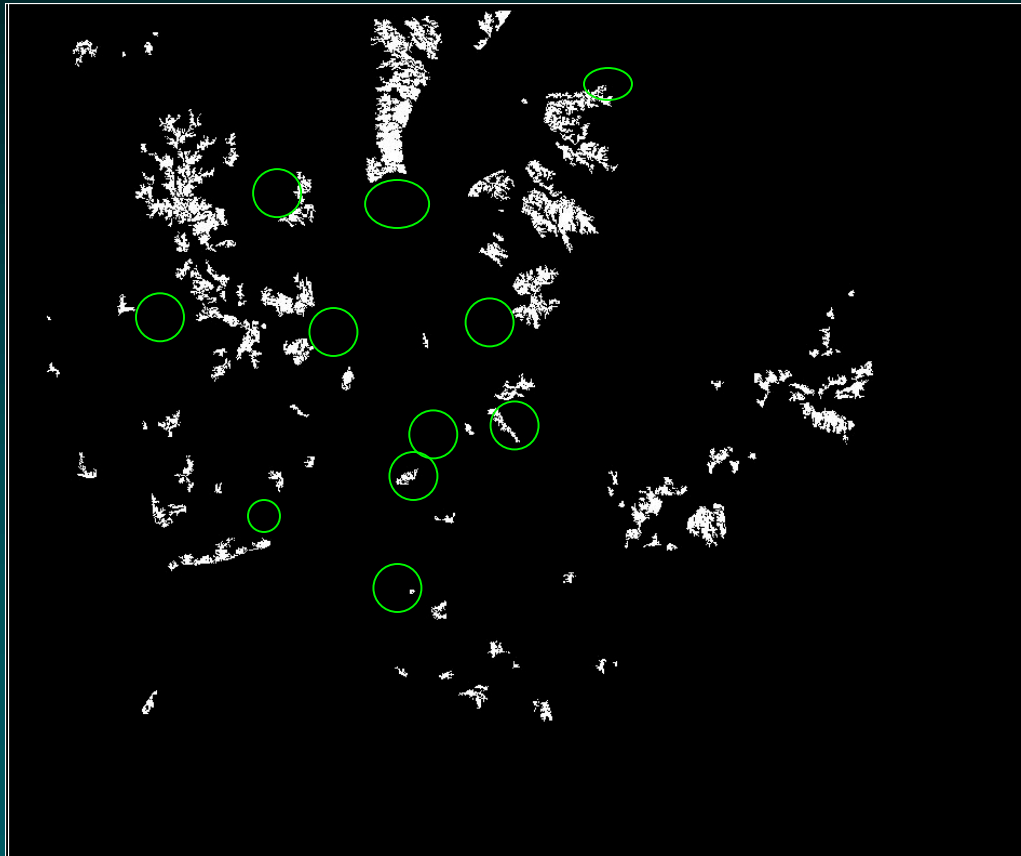
# Habitat Fragmentation

- Landscape consideration
  - spatial arrangement of potential habitat is important



# pLEAM Fragmentation

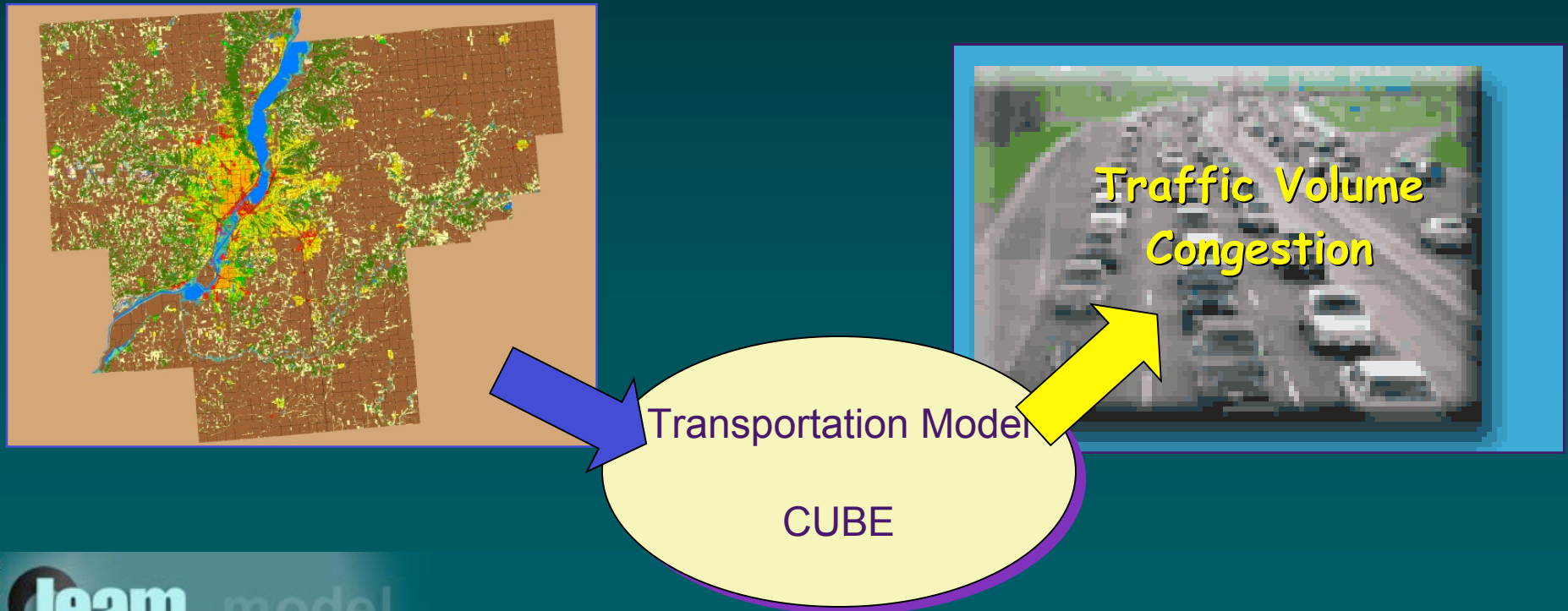
Spatial results



# Exogenous Approach

## LEAM/Transportation Model Interface

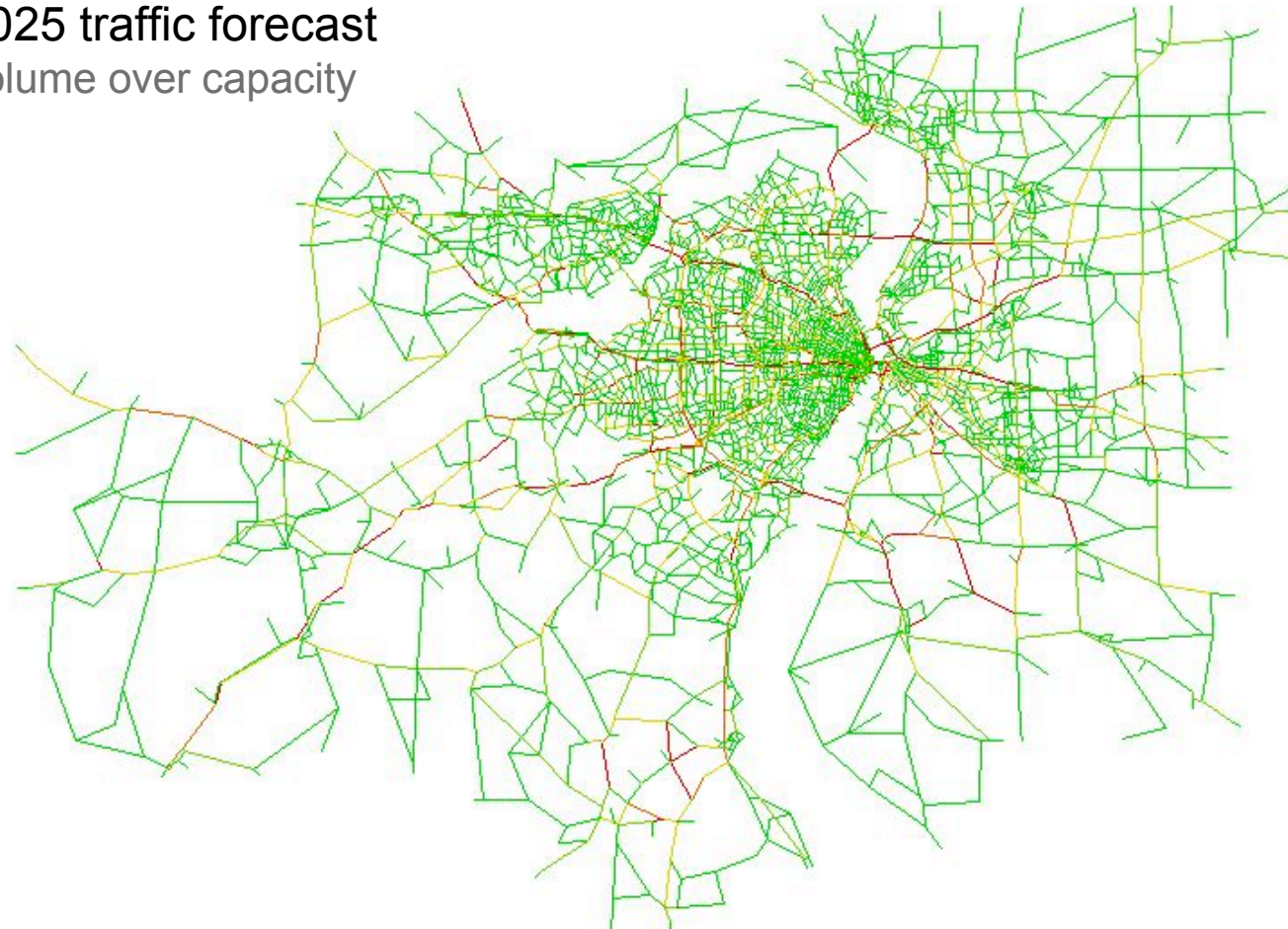
- Linking land use change with transportation models
- Impacts of Land Use on Traffic Congestion





# CUBE Model Output

2025 traffic forecast  
volume over capacity



v/c values in percentage

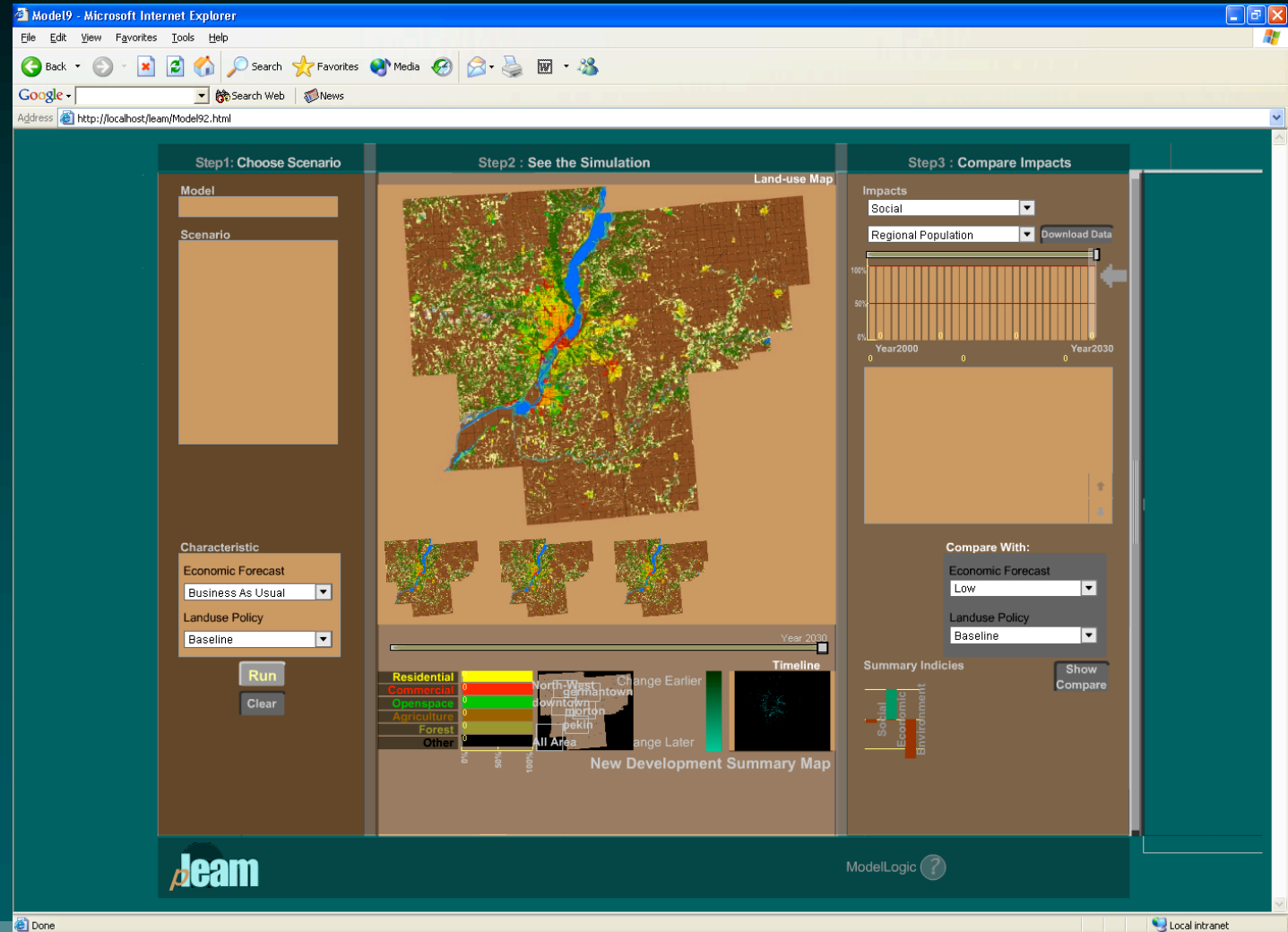
- 0 - 25
- 24 - 50
- 51 - 79
- 80 - 95
- 96 - 183

# Output Detail

- 2025
  - Bridge congestion
  - Illinois growth and congestion



# User Interface



# Drivers and Scenarios

- Understanding Drivers
- Understanding Scenarios



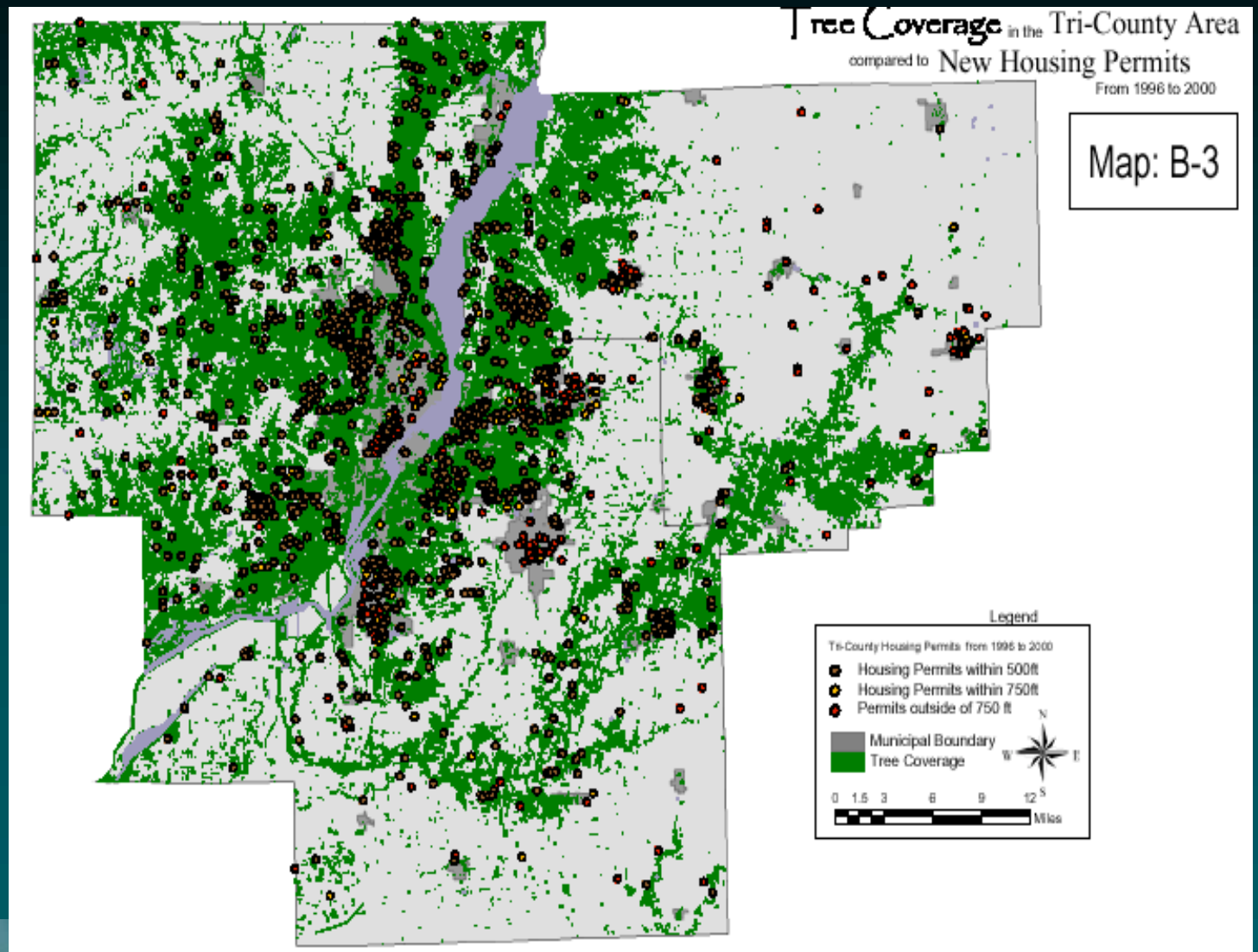
# Understanding Drivers

- Drivers are factors that influence
  - Where new growth takes place
  - Where decline takes place
- Example from Peoria

# Understanding Drivers

- Drivers are factors that influence
  - Where new growth takes place
  - Where decline takes place
- Example from Peoria
  - Forests are attractors of growth

# Peoria: New Housing and Forests



# Understanding Scenarios

- Scenarios describe different interesting policy choices or public investments
- Example from Peoria

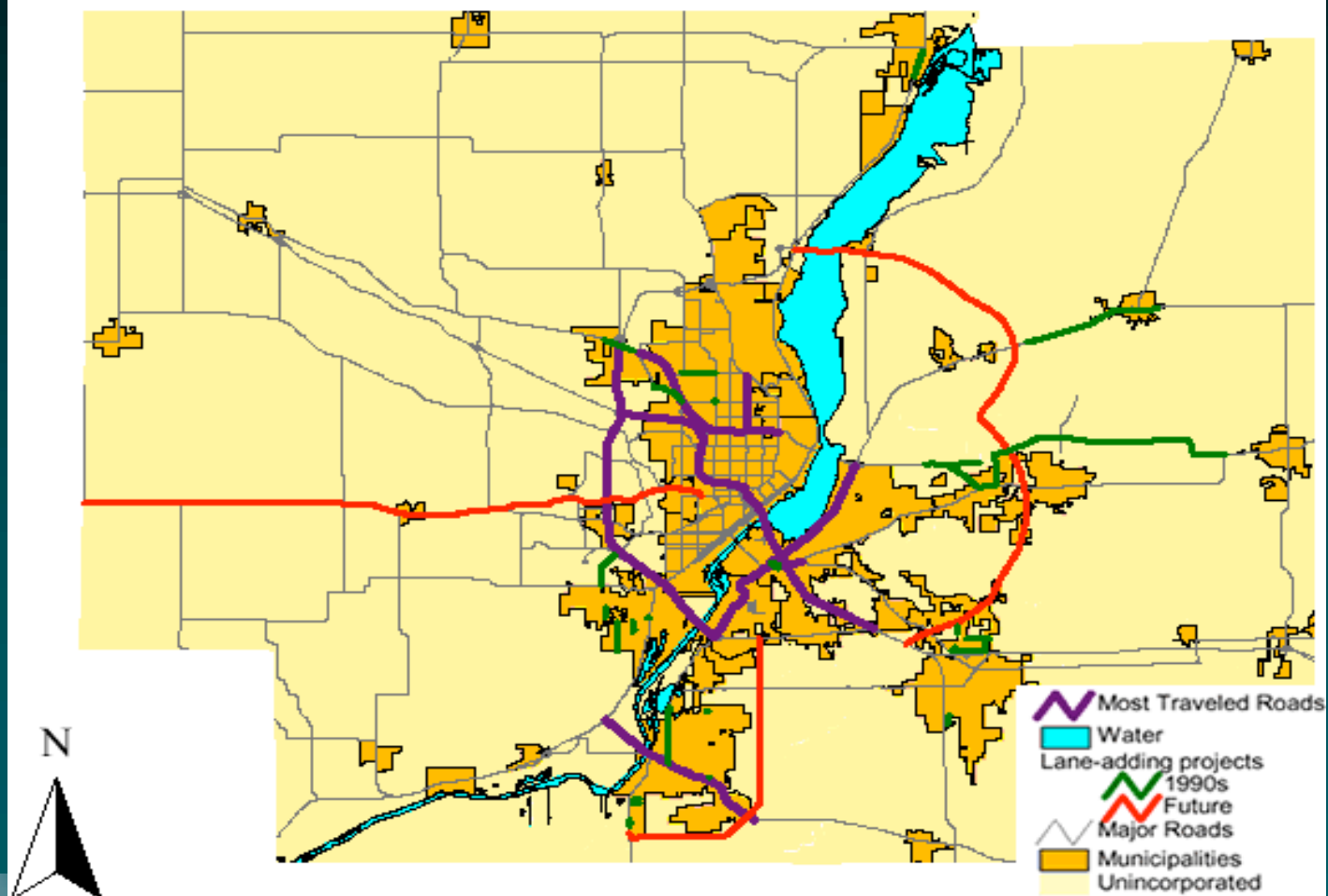


# Understanding Scenarios

- Scenarios describe different relevant policy choices or public investments
- Example from Peoria
  - Construct a new eastern by-pass around the city

## Scenario: New Road Construction

Map D-2 : Major Road Projects



# Charrette Task

## To create a LEAM for Kishwaukee Basin

- What are the most important drivers of land-use change in the region?
- What are scenarios of interest to the region?
  - Public policy choices
  - Public investment decisions

# Process

- Examine generic LEAM land-use simulations
  - In what ways are they unsatisfactory?
  - What drivers could be added to make them better?
- Identify and prioritize Kishwaukee drivers
- Identify and prioritize Kishwaukee scenarios



# Generic LEAM

LEAMg

# LEAMg

- LEAM with an incomplete set of drivers
  - Uses National data sets
  - No local information
- Does NOT represent our best guess for the future of the area
- Intended to initiate a dialogue in the region

# What Drivers Are Included?

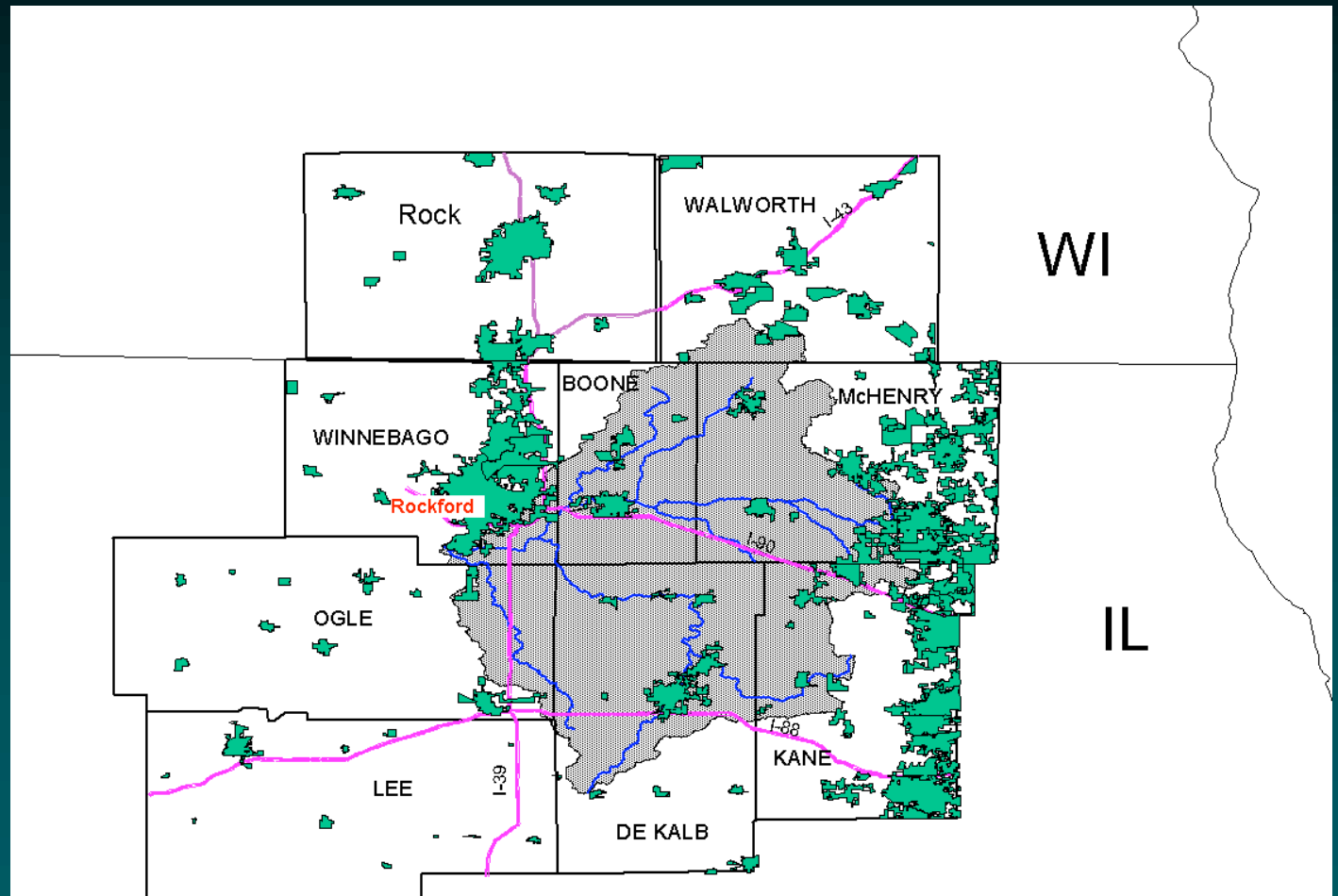
- **Census Data**
  - Provides county by county population projections
  - Aggregated to entire region
- **Municipal Boundaries**
  - Growth trends - attracts development to existing communities
- **Cities Attractor**
  - Gravity model based on travel times
- **Transportation Drivers**
  - Ramps
  - Major intersections
  - Highways
  - County Roads
- **Elevation**
  - High slopes discourage development

# What Drivers Are Included?

- Water
  - Attracts open space
- Neighborhood development
  - Development is attracted by other development
- Utilities
  - Are utilities available in the area
- No Growth Zones
  - Military Bases
  - National Forest Areas

# Building LEAMg for the K Basin

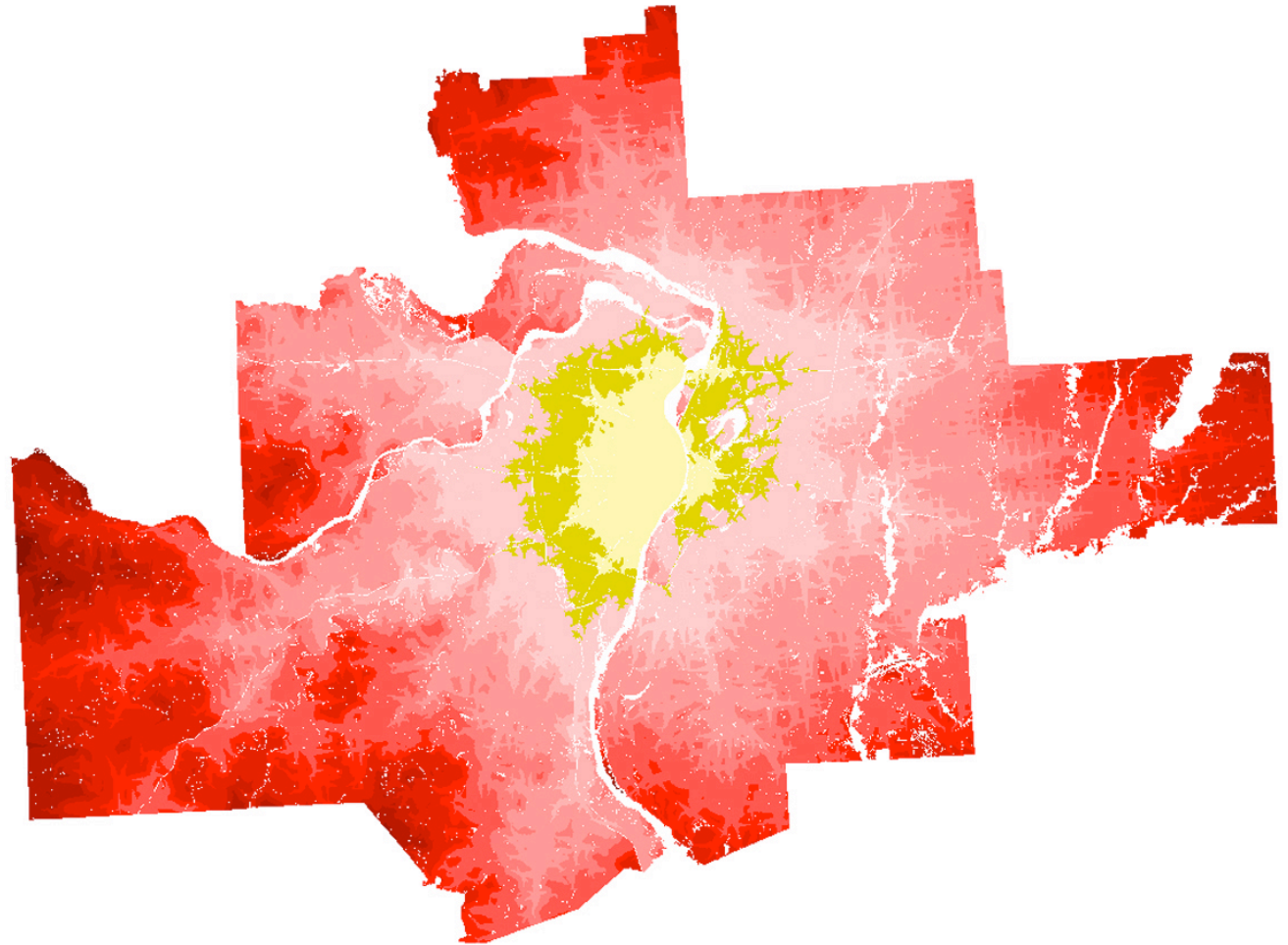
- Nine County area





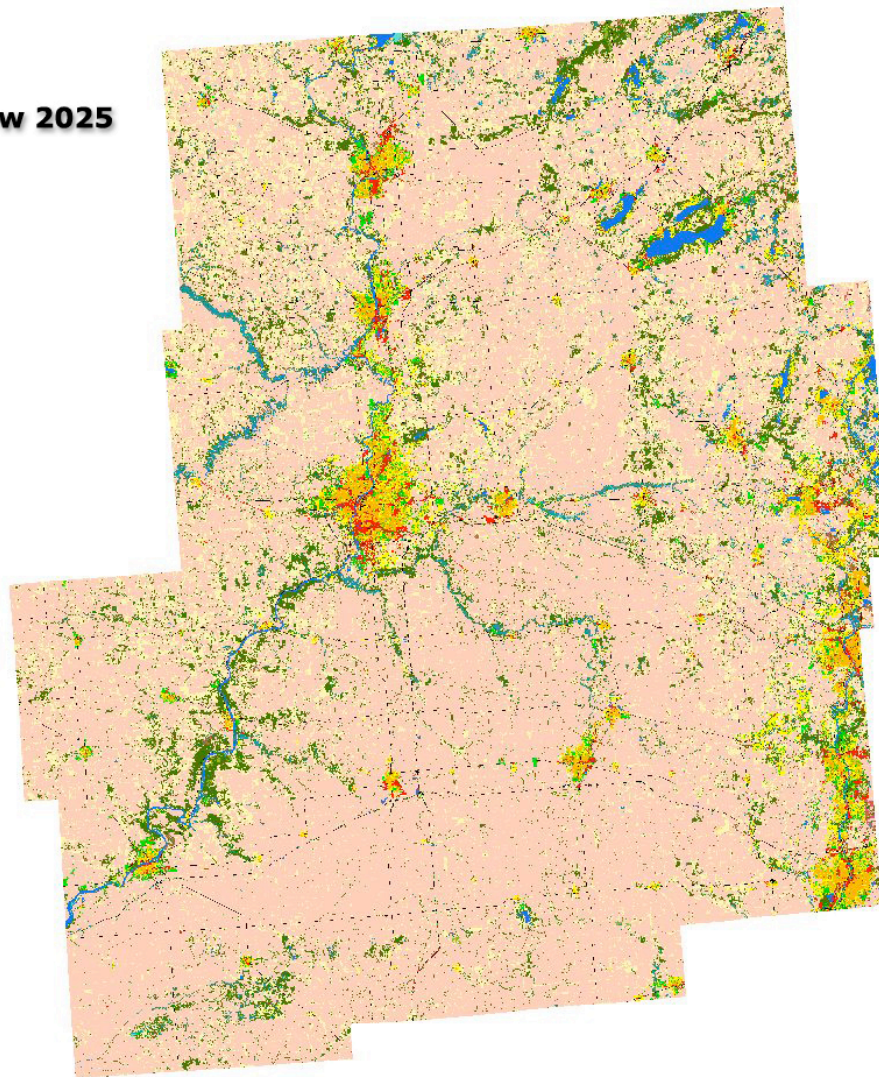
# Driver Example

- StL major cities attractor example



# Kish LEAMg Results

**Landuse Map  
Kishwaukee Low 2025**

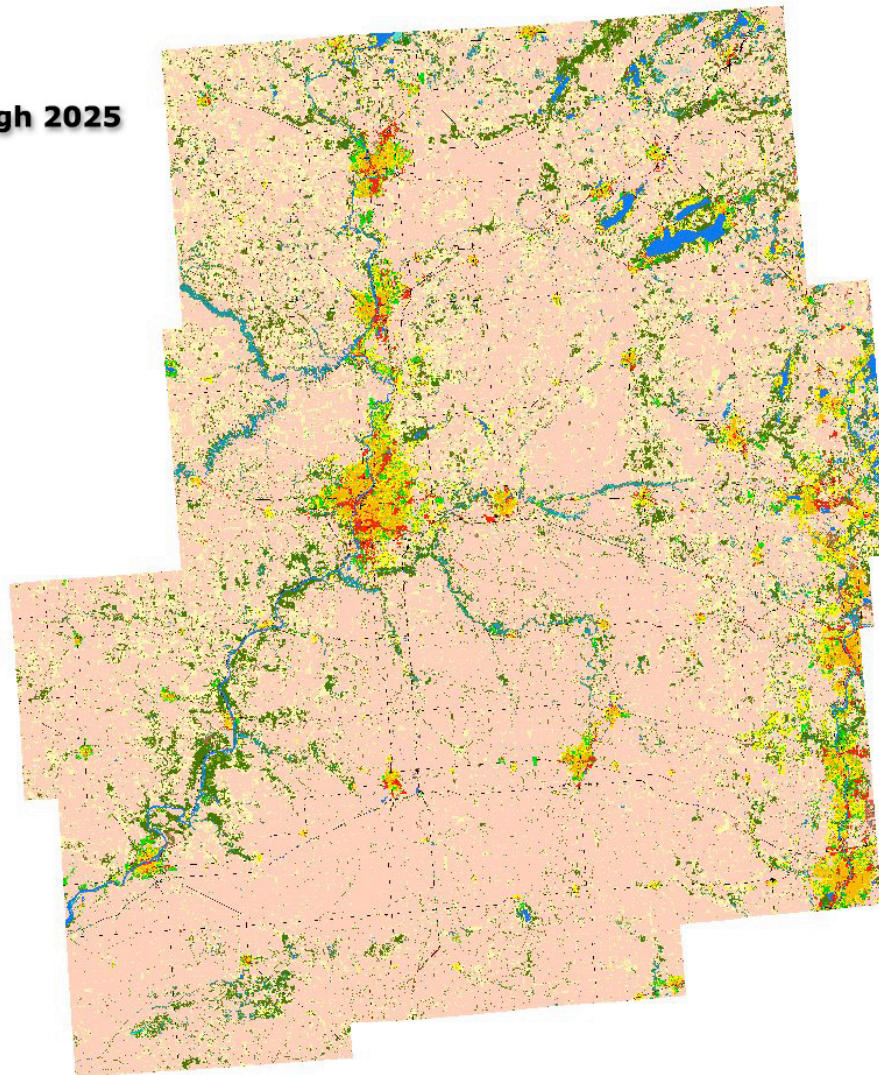


- water
- Low Intensity Residential
- High Intensity Residential
- commercial/Industrial
- roads
- Bare Rock/Sand/Clay
- Quarries/tripmines/Gravel Pits
- Transitional
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Grassland/Herbaceous
- Pasture/Hay
- Row Crops
- Small Grains
- Urban Recreational Grasses
- Woody Wetlands
- Emergent Herbaceous Wetlands



# Kish LEAMg Results

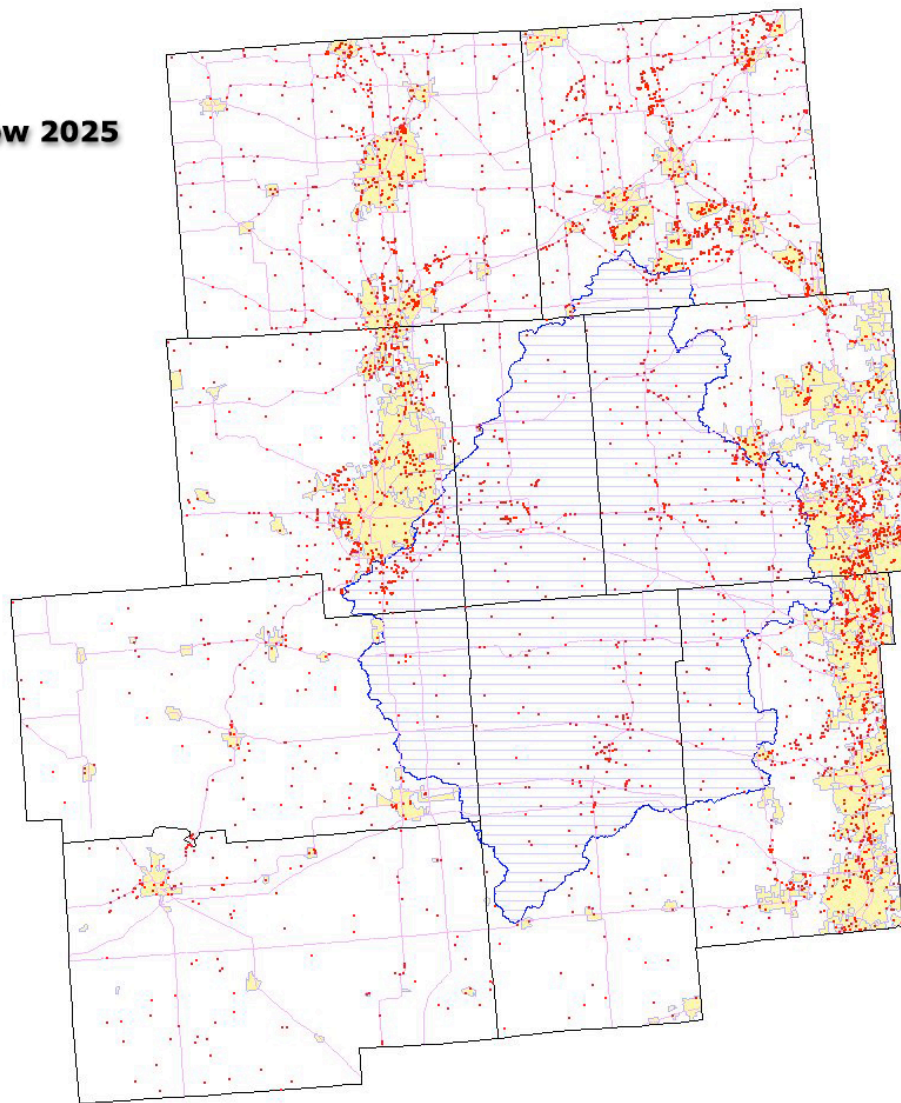
**Landuse Map  
Kishwaukee High 2025**



- water
- Low Intensity Residential
- High Intensity Residential
- commercial/Industrial
- roads
- Bare Rock/Sand/Clay
- Quarries/stripmines/Gravel Pits
- Transitional
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Grassland/Herbaceous
- Pasture/Hay
- Row Crops
- Small Grains
- Urban Recreational Grasses
- Woody Wetlands
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# Kish LEAMg Summary

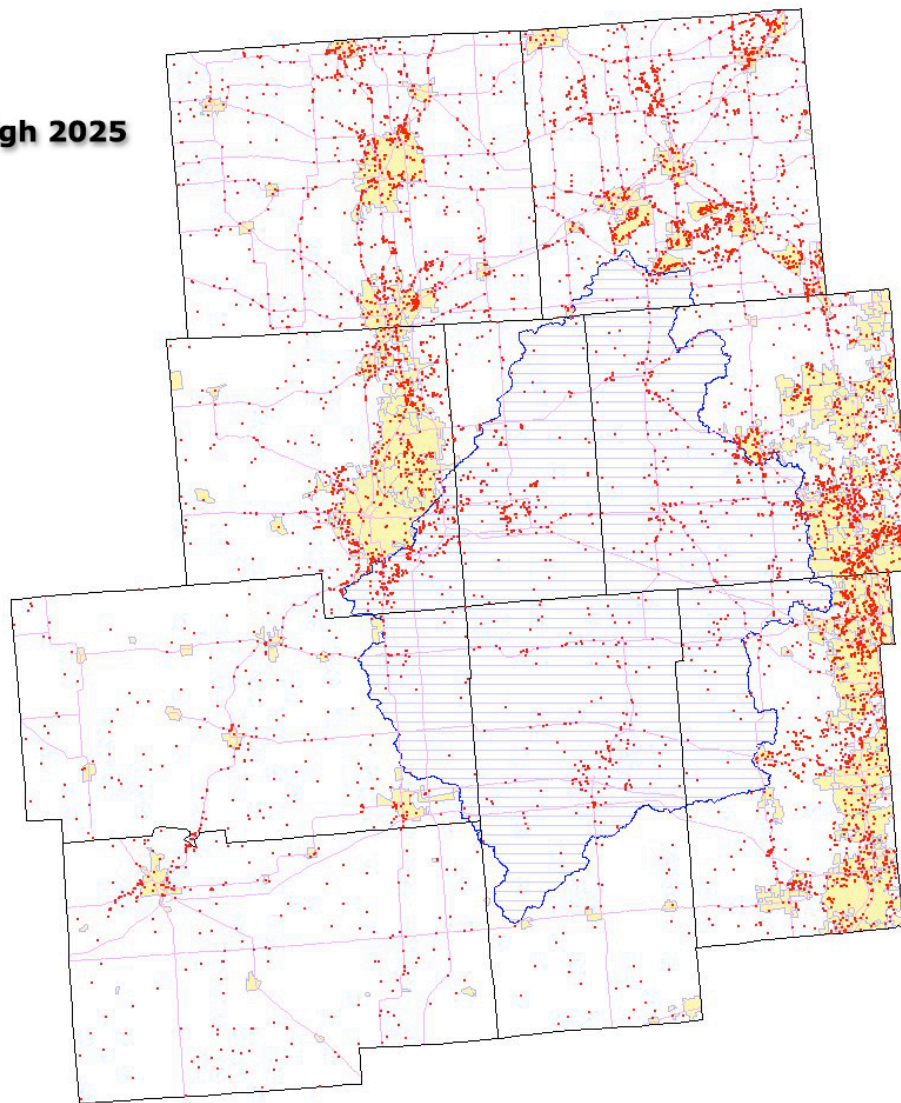
**Summary Map  
Kishwaukee Low 2025**





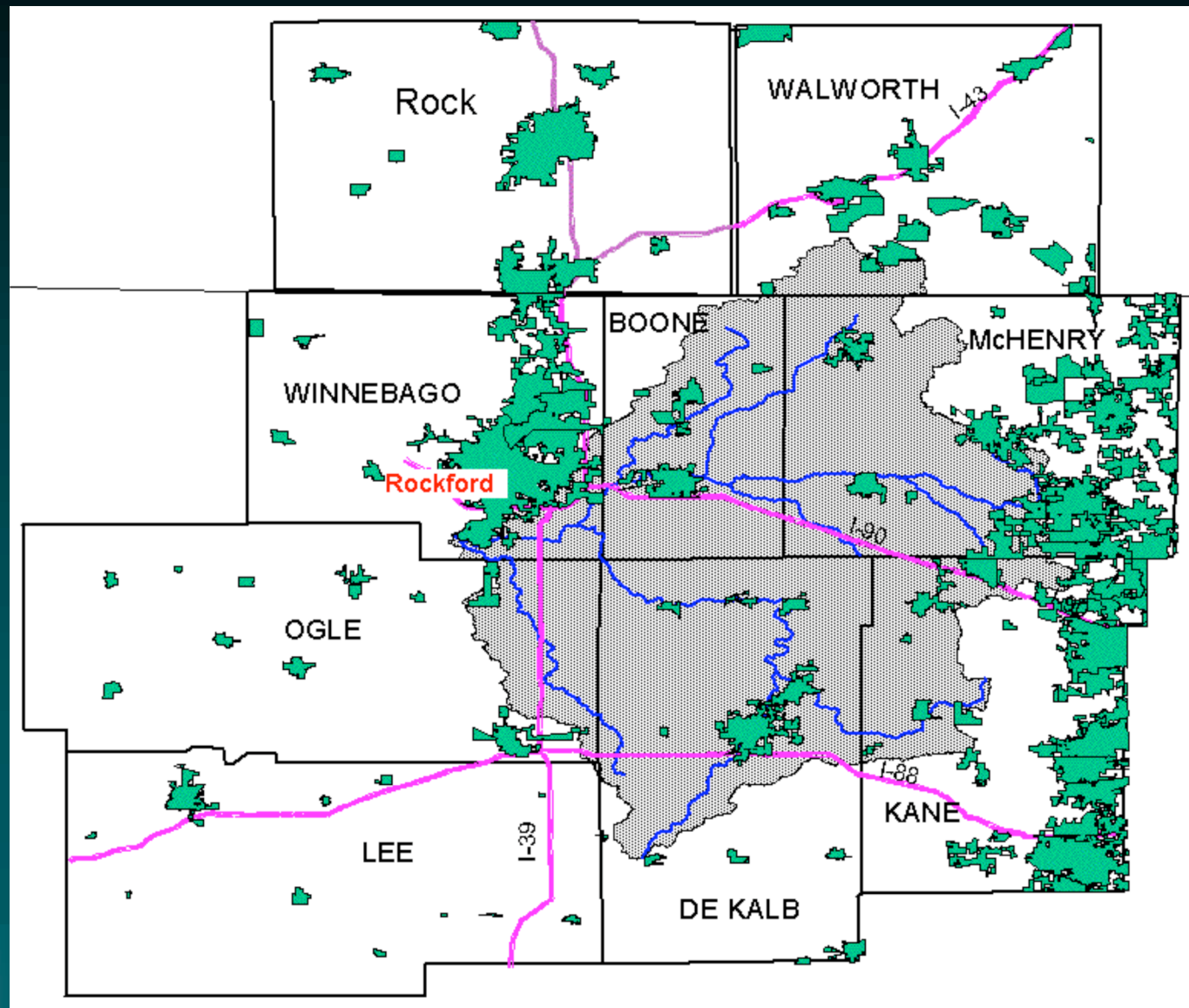
# Kish LEAMg Summary

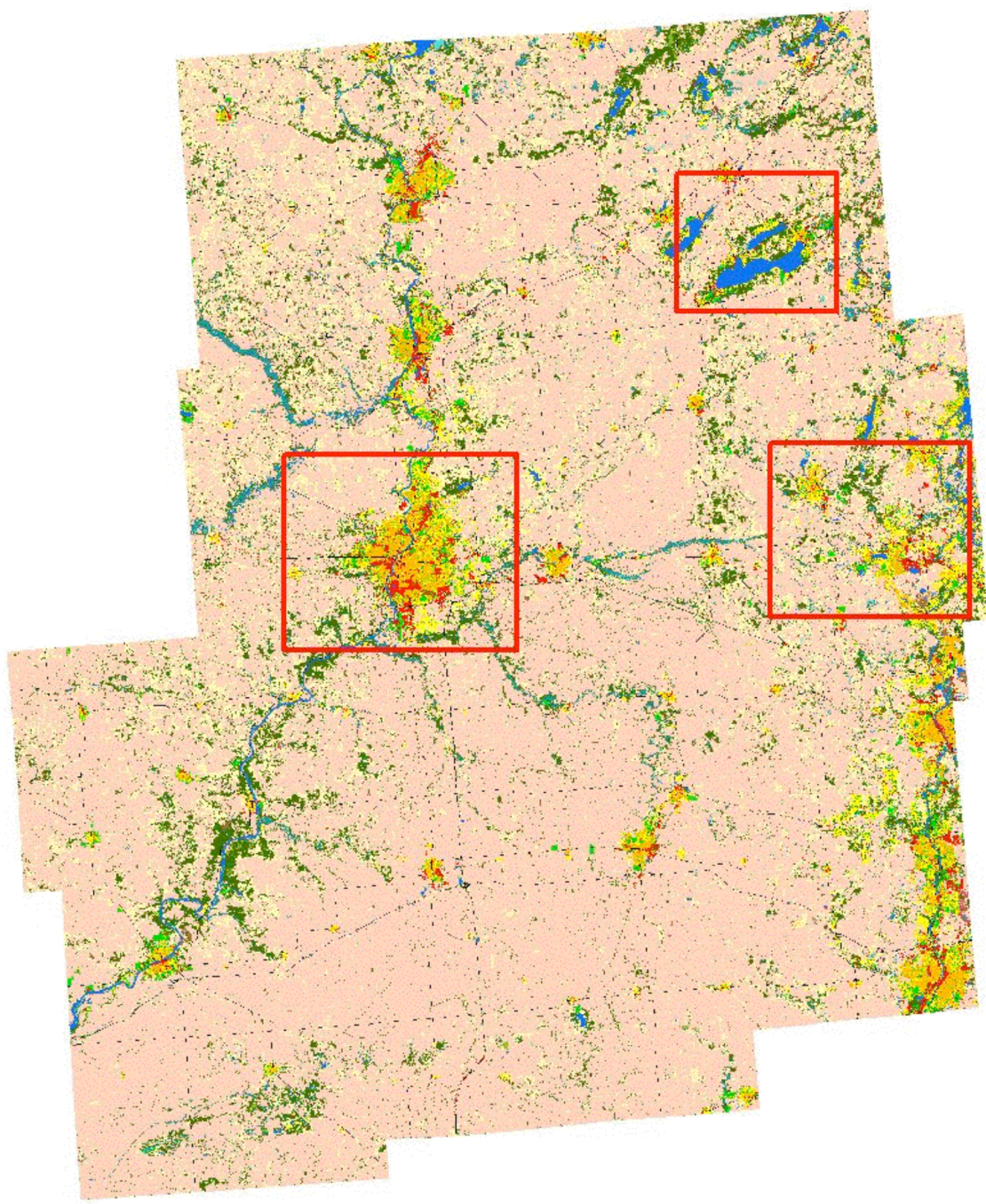
**Summary Map  
Kishwaukee High 2025**





# Existing Urban Areas

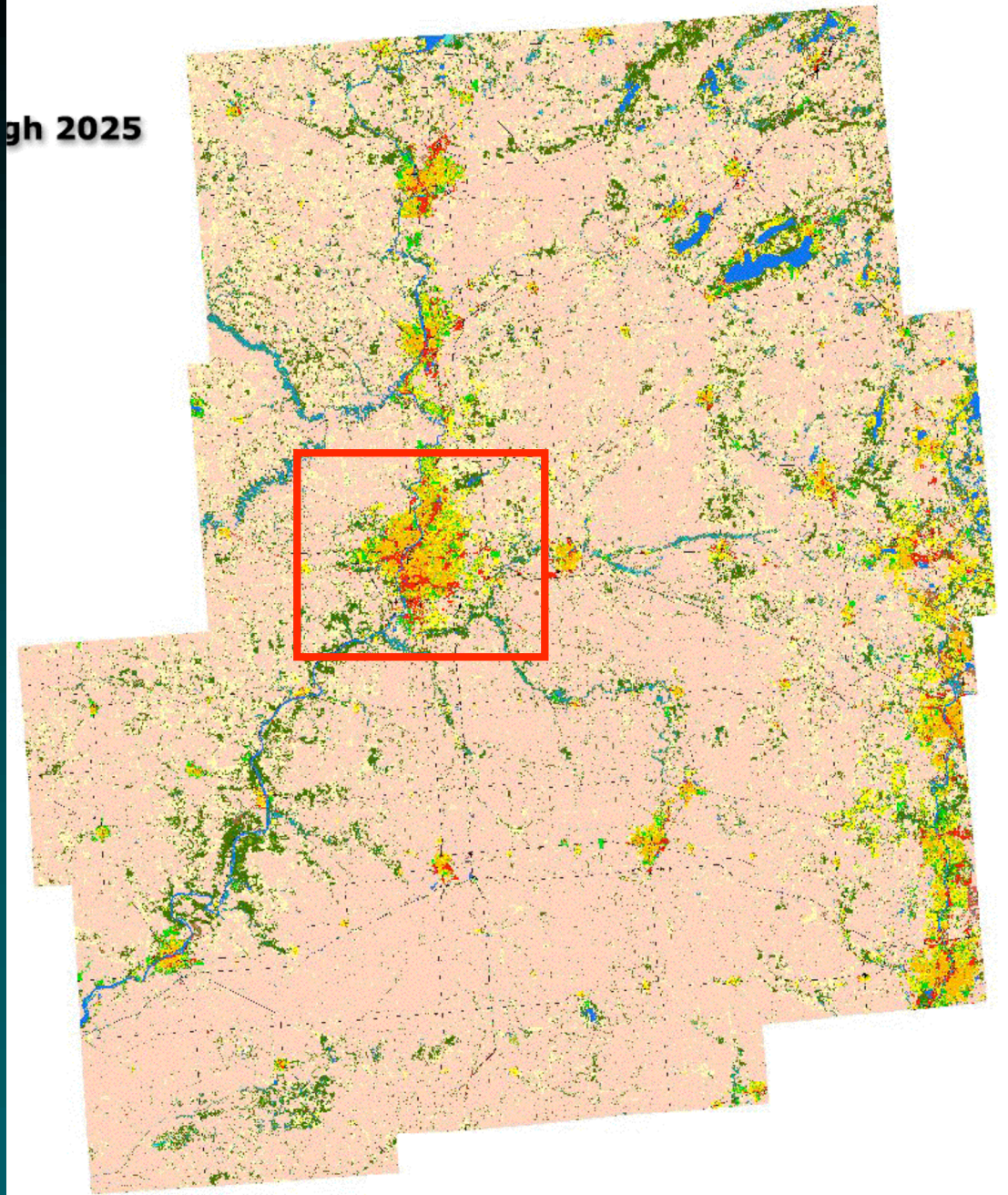






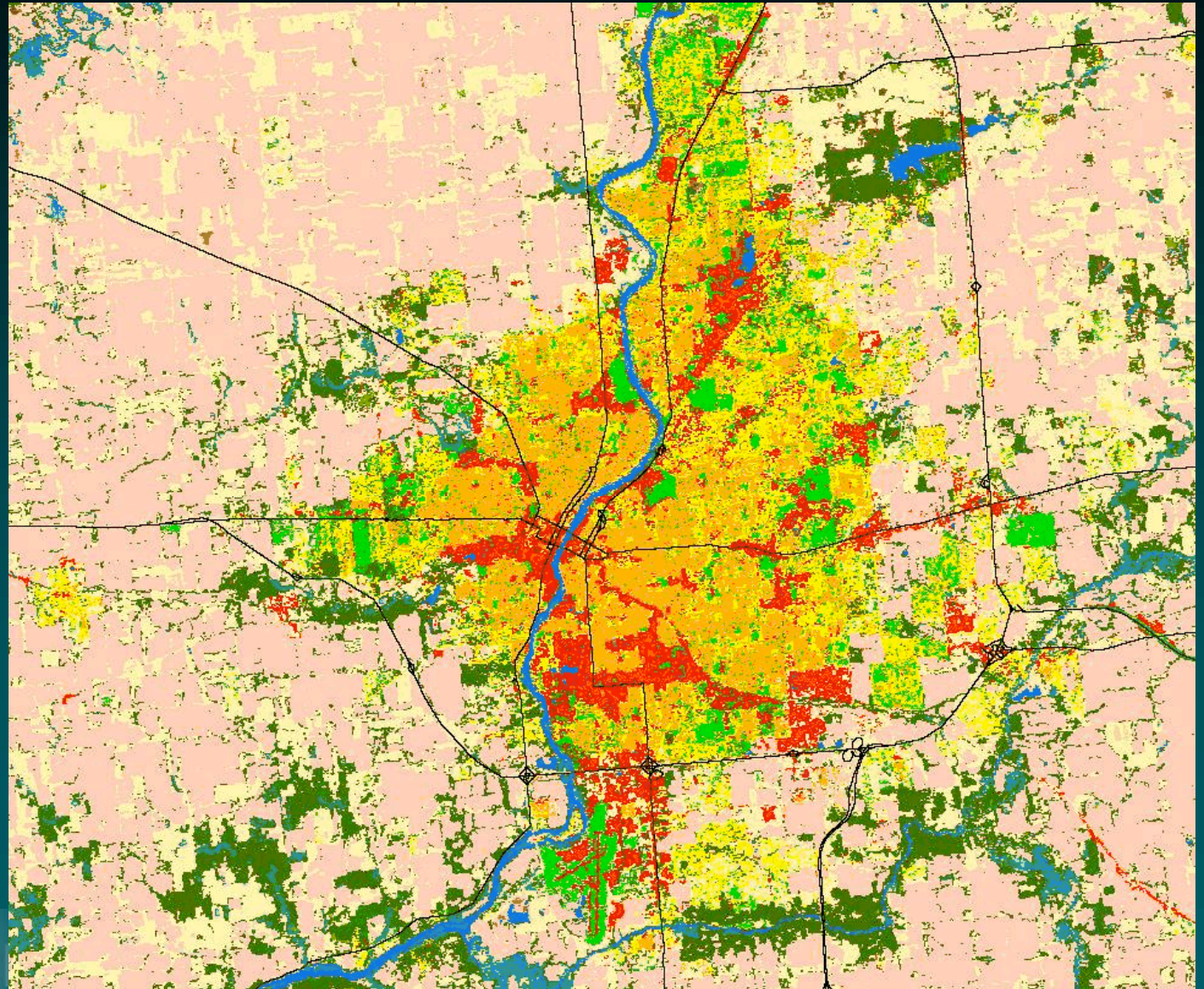
# Kish LEAMg Summary

gh 2025





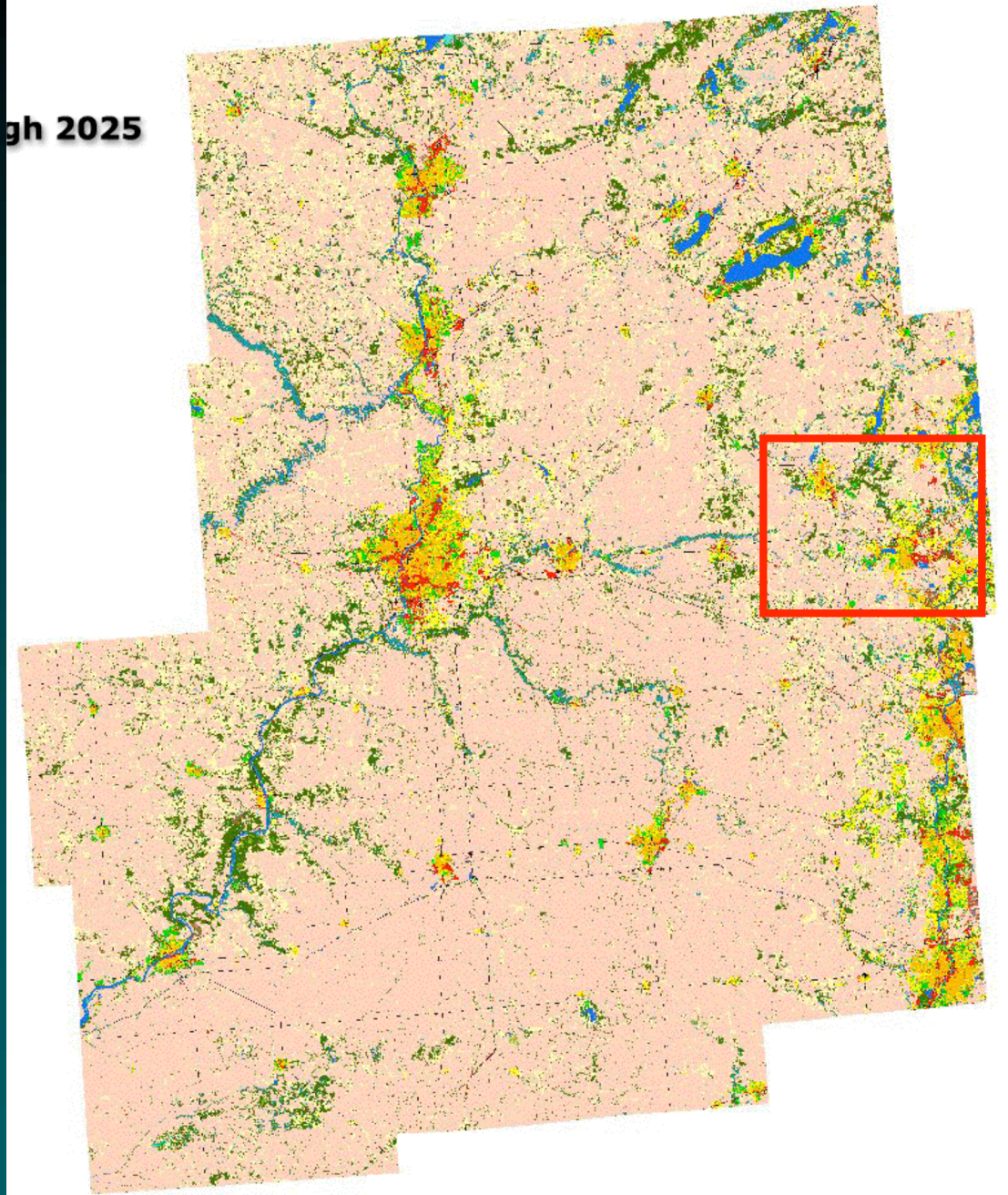
# Rockford





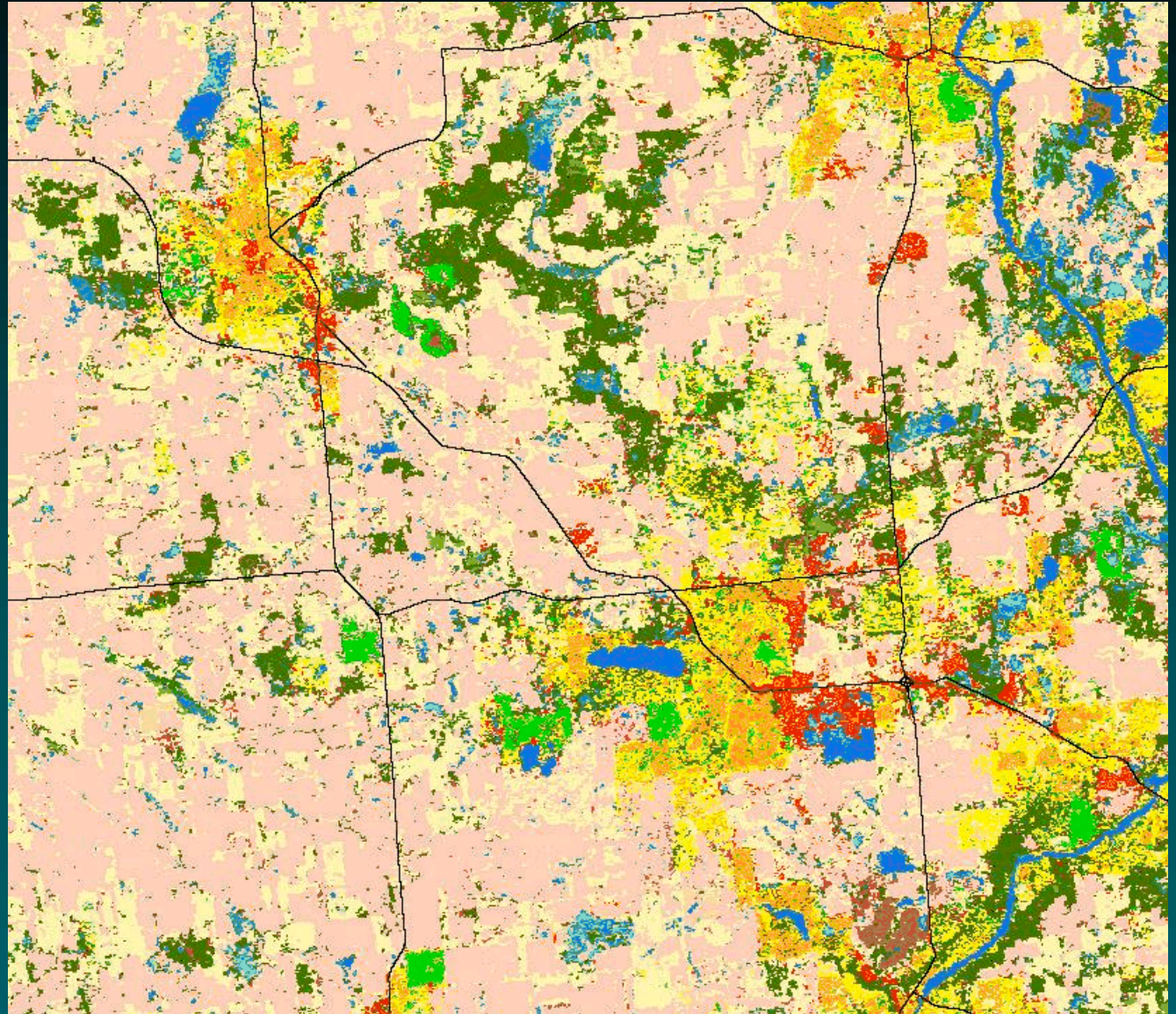
# Kish LEAMg Summary

gh 2025





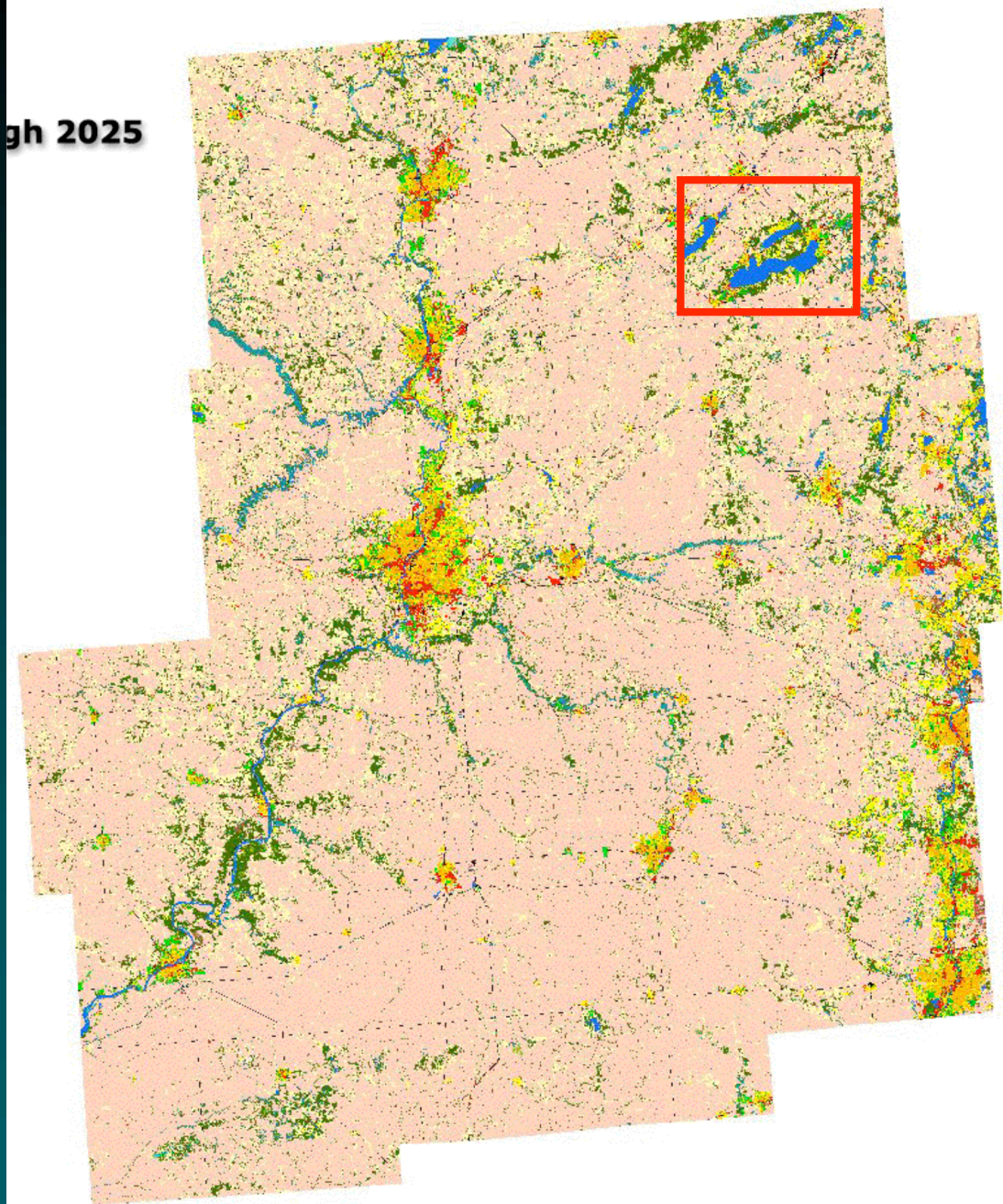
# McHenry County





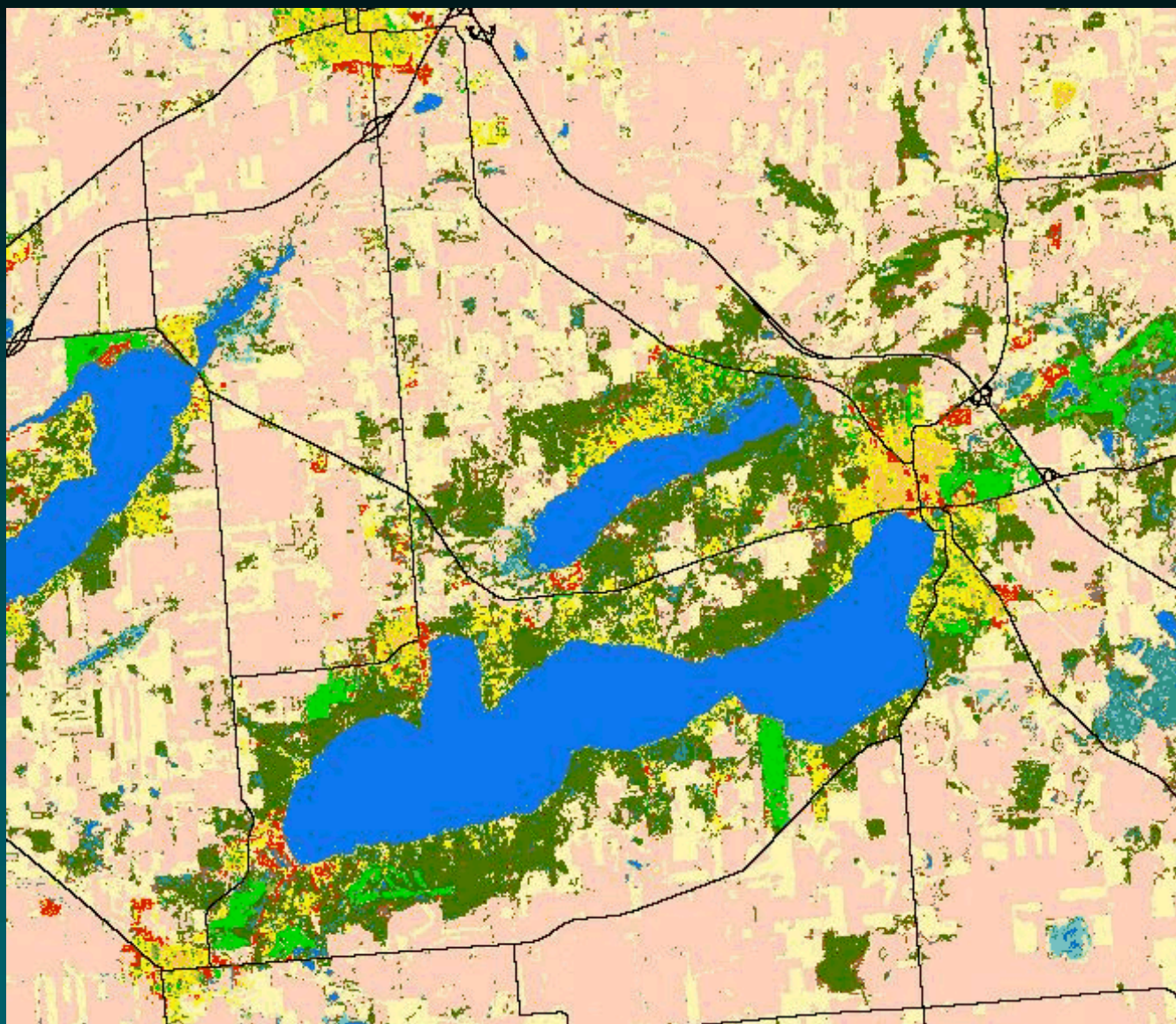
# Kish LEAMg Summary

gh 2025





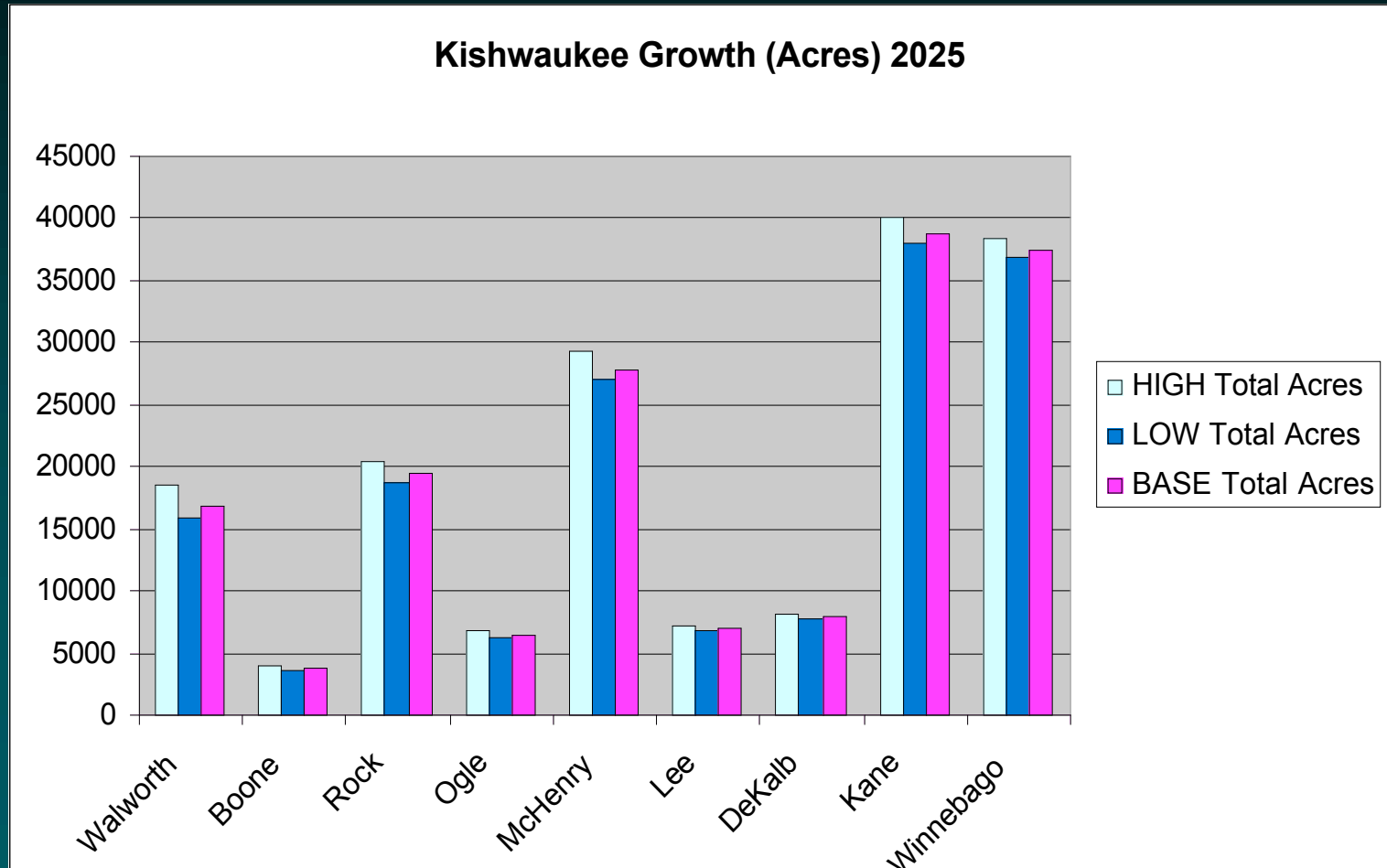
# Walworth County



# Changes in Land Use

Landcover Classification	Initial Land Use	High Growth 2025	Moderate Growth 2025	Low Growth 2025
Water	38887	38887	38887	38887
Residential	120169	147394	141931	138712
Commercial/ Industrial	28248	34592	33322	32571
Forested	288225	274578	276726	278213
Grasslands	19207	18008	18234	18355
Agricultural	2173147	2160678	2163519	2165121
Urban Openspace	36160	40703	39799	39253
Others	693596	682799	685223	686528
Total	3397640	3397640	3397640	3397640

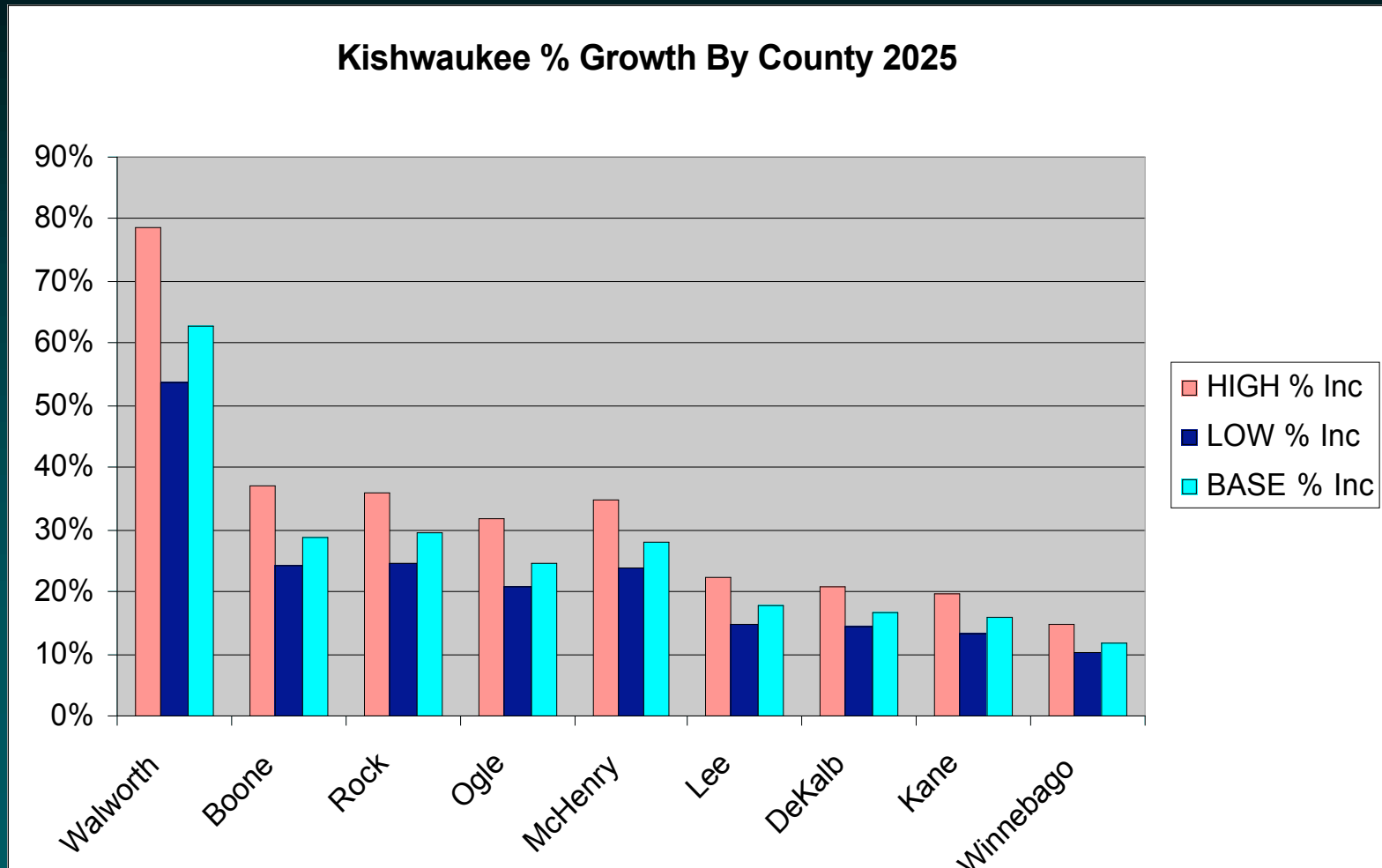
# Urban Increases by County in Acres





# Urban Increases by County

percentage increases



# Specific Charrette Tasks

# Specific Tasks for Teams

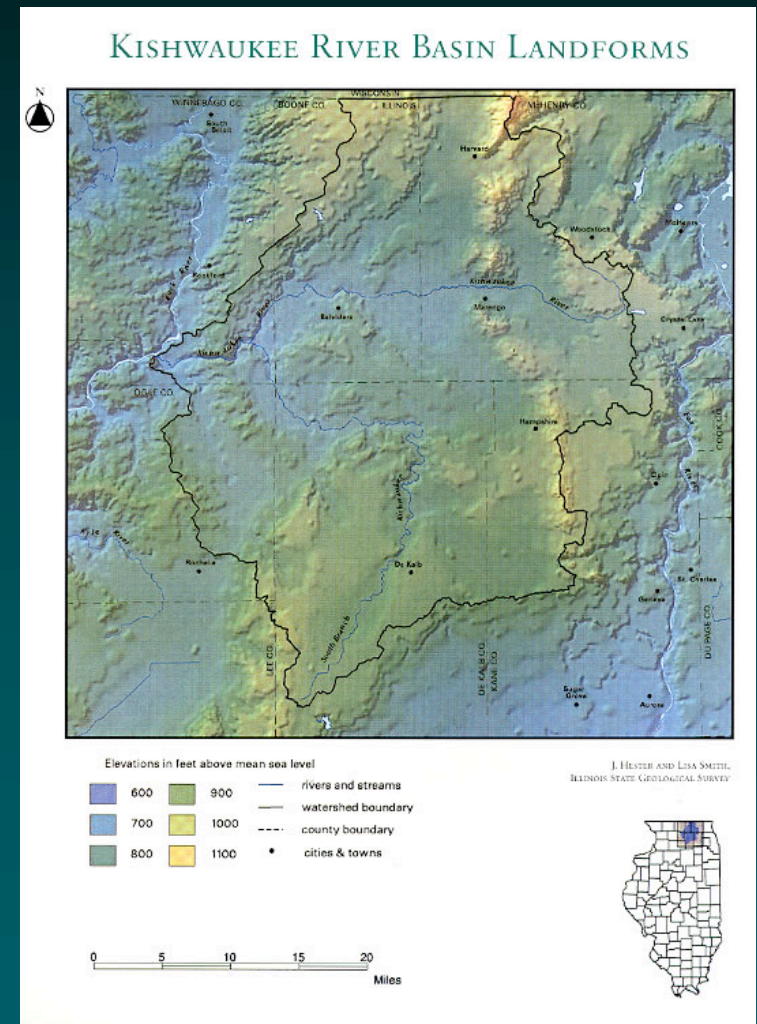
- Examine generic LEAM land-use simulations
  - In what ways are they unsatisfactory?
  - What drivers could be added to make them better?
- **St. Louis Metro Drivers**
  - Separately: Identify drivers
  - Collectively: Review and prioritize
- **St. Louis Metro scenarios**
  - Separately: Identify scenarios
  - Collectively: Review and prioritize
- Review the Process

# Conclusion

# Planning for a Region

Finding answers to three questions

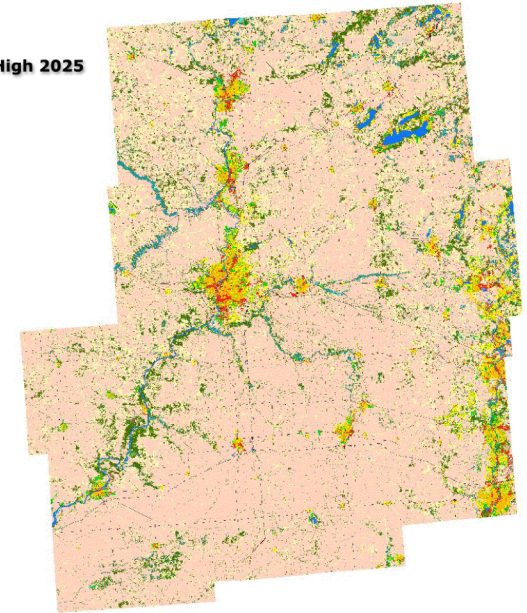
- Where are we now?
- Where do we want to be?
- How do we get there?



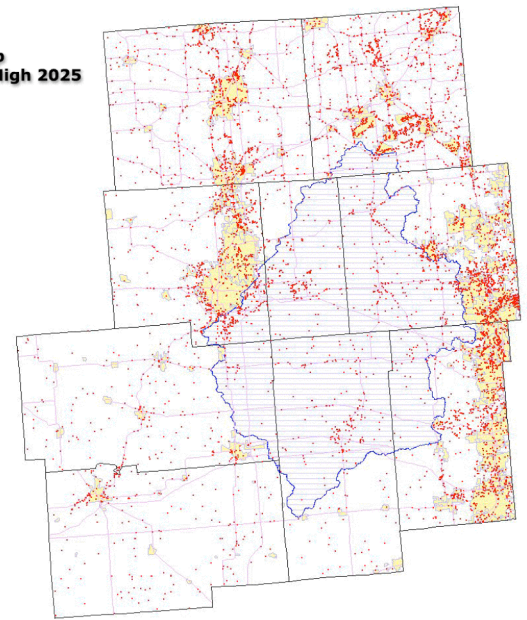
# LEAM Technology

- Models causal mechanisms of land-use change explicitly
- Simultaneously models impacts of change
- Runs in high-performance computing environments (massively parallel)
  - Can handle large regions at a fine resolution (30m x 30m)
- Can integrate with external models
  - Exogenous models
- Can examine system feedbacks
  - Endogenous models

Landuse Map  
Kishwaukee High 2025



Summary Map  
Kishwaukee High 2025





# More Information

[www.learm.uiuc.edu](http://www.learm.uiuc.edu)

[deal@uiuc.edu](mailto:deal@uiuc.edu)

